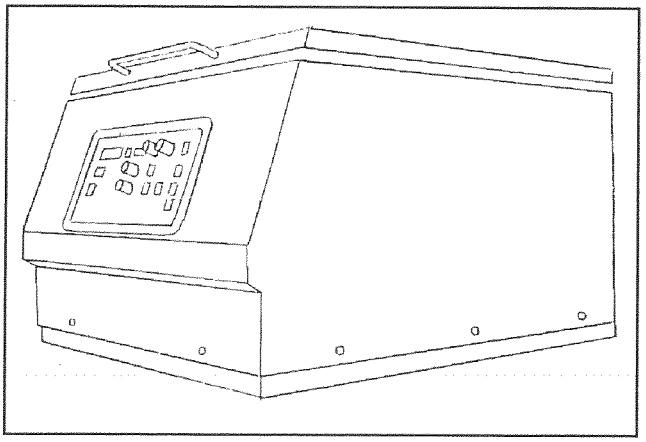
# SERVICE MANUAL
# FOR
# LABORATORY
# CENTRIFUGES

## Z 513 / Z 513 K



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| Z 513 ; 230 V | | | |
|---|---|---|---|
| Rotor | Acceleration time in sec. | Deceleration brake intensity "0" | Deceleration brake intensity "9" |
| 220.70V05 | 60 | 254 sec. | 81 sec. |
| 220.70 V06 | 99 | 731 sec. | 180 sec. |
| 220.70 V07 | 59 | 294 sec. | 134 sec. |
| 220.80 V02 | 51 | 772 sec. | 169 sec. |
| 220.76 V03 | 51 | 753 sec. | 169 sec. |
| 220.78 V03 | 58 | 739 sec. | 237 sec. |
| 220.41 V03 | 17 | 91 sec. | 17 sec. |

| Rotor No. | speed in rpm | Lowest sample temperature |
|---|---|---|
| 220.70 V06 | 5000 | + 8° C |
| 220.70 V05 | 3600 | +10° C |
| 220.29 V03 | 3200 | - 5° C |
| 220.41 V03 | 2000 | - 5° C |
| 220.78 V02 | 15000 | + 5°C |
| 220.80 V02 | 15000 | + 2°C |
| 220.76 V02 | 15000 | + 0 °C |
| | | |

Ambient temperature: +25° C

The absolute end temperatures can be subject to flucations of ± 2° C due to power tolerances of the refrigeration unit.
The lowest sample temperature are depending on the ambient temperature.
If the ambient temperature is increasing, the lowest sample temperature that can be reached, is increasing as well.

| Z 513 | | | |
|---|---|---|---|
| **Rotor No.** | **Cutoff speed** in rpm | **Allowed imbalance** in grams | **Cutoff imbalance** in grams |
| 220.70 V06 | 2000 | 13 | 15 |
| 220.70 V05 | 1960 | 15 | 16 |
| 220.29 V03 | 1960 | 14 | 16 |
| 220.41 V03 | 1930 | 15 | 17 |
| 220.78 V02 | 1900 | 49 | 51 |
| 220.80 V02 | 1960 | 52 | 54 |
| 220.76 V02 | 1980 | 58 | 60 |
| | | | |

| Z 513 K | | | |
|---|---|---|---|
| **Rotor No.** | **Cutoff speed** in rpm | **Allowed imbalance** in grams | **Cutoff imbalance** in grams |
| 220.70 V06 | 1920 | 13 | 15 |
| 220.70 V05 | 1950 | 14 | 16 |
| 220.29 V03 | 1960 | 14 | 16 |
| 220.41 V03 | 1930 | 15 | 17 |
| 220.78 V02 | 1920 | 35 | 37 |
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The Z 513 / Z 513 K is a microprocessor controlled laboratory centrifuge.
The actuation is a three-phase asynchronous motor which is controlled by a frequency converter.
The unit has an independent diagnostic program which helps you with the trouble shooting by indicating the error number on the digital display.
The 12K / KBR is equipped with several safety facilities as imbalance recognition, overspeed protection and overtemperature protection of the motor.

**Please follow the below mentioned safety instructions for any kind of service:**

- The capacitor of the frequency converter can be under voltage, even if the unit is switched off.

- Don't leave units without supervision, where you have removed some parts of the housing and the unit is still connected to the main power.

- Don't bypass the lid safety contacts and never work with the lid open.

- The VDE regulations are valid for all electrical work that has to be done.

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## 1. Power board:

The power board is serving the low voltage supply of the centrifuge control system. All fine wire fuses for the different distribution voltages are placed on the power board (see chapter 4, layout of the HE 121.00.03).
The power board is electrically isolated and has an electrical strength of 4 KV.
It is also the central switching point for all inputs and outputs.
The signal line of the microprocessor controller is consisting of a flat belt cable. All plug connections are placed in such a way that they cannot be accidentally misconnected.

## 2. Front panel (Operational control):

On the front panel the CPU and the EPROM for the centirfuge software is located. The front panel controls the hole centrifuge. If there is a defect please exchange the complete panel, not only the prinited circut board.
The signal line, the power supply lines and the temperature signal line are leaded to the control board (no confusion possible).
The safety facilities are additionally safeguarded by a hardware circuit on the power board.
If a mistake should occur you can see the error message on the digital display of the front panel.

### 2.1 Adjustment of the front panel

The front panel can be used in different units, therefore it must be programmed to the model where it is used. See chapter 3.3/6 in the self test program.

**Attention: If you have to replace the front panel you have to make sure that the panel is programmed correctly.**

### 3. Frequency converter:

The frequency converter generates the drive signals for the asynchronous motor.
The converter leads the current, which is generated by the motor during deceleration, to a heating resistor to reduce the current.
The frequency converter is connected with the power board by a serial interface.
On the converter is a green LED which lights when the frequency converter is working correctly. A defect of the converter will be indicated as an error no. on the digital speed display (see chapter 5 "Error messages"), and the green LED will not light.

### 4. Rotor identification and overspeed protection:

The centrifuge always recognizes the inserted rotor by a Hall-effect sensor.
All rotors are equipped with a coded indicator ring (magnet-ring).
The hall-effect sensor takes signals of the magnets and is passing them on to the processor. If the preset speed is higher than the max. allowed speed of the inserted rotor, the actual speed indication is flashing now during acceleration, beginning at approx. 200 rpm.
But the CPU accelerates the rotor only up to the max. allowed speed of the rotor.
During acceleration the speed of the rotor will also be observed by a hardware circuit which is integrated on the power board. Due to this double observation the motor can never run with a higher speed than allowed.

### 5. Speed signal:

The actual speed will be measured by a Hall Sensor which is placed on the bottom side of the motor.
The signal will be transmitted by the power board to the control board and the converter.

### 6. Lid lock:

The Z 513 K series has a automatically lid lock. The lid lock closes the lid automatically by using a motor force. A small amount of pressure is enough to activate the locking system. It take approx. 6 sec. to close the lid. By pressing the lid key the lock opens within 6 seconds.
For emergency lid release, follow the instruction manual " Emergency lid release".

### 7. Imbalance recognition:

The imbalance recognition is effected by a micro switch which is controlling the oscillating motion of the motor. The unit will stop if the oscillating motions are too strong.
You have to follow the adjustment instructions stated by the manufacturer.

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## 1. Activating of the self test program

The self test program helps the service personnel to locate defects.

The program can be started as follows:

- Open the centrifuge lid and switch off the main switch.
- Press the keys "rpm/g-value" and "time/radius" down together and at the same time switch on the main switch.
- Let go of keys "rpm/g-value" and "time/radius".

Each digit of the display must now be a minus (-) symbol.

## 2. Keyboard test

With the keyboard test you can check the correct function of the foil keyboard.
Activate the self test program (as described under 1).
Press the key "rpm/g-value" to start the keyboard test. Then "1" appears on the digital display "brake".

By pressing the other keys always a number appears which is assigned to the keys.

| Key | Number |
|---|---|
| rpm/g-value | 1 |
| quick | 2 |
| time/radius | 3 |
| up | 4 |
| lid | 5 |
| down | 6 |
| store | 7 |
| start | 8 |
| precool | 9 |
| stop | Exit the keyboard test |

If one of those numbers does not appear or if the keyboard test can't be started or ended, you have to replace the complete operational control.

### 3. Indication test

Activate the self test program (as described under point 1).

The indication test can be activated by pressing key "radius/time".
The digits 0 - 9 appear (half a second timing pulse) on all digital indications. Also the LED's of the keys, both minus ( - ) signs of the temperature display and the point between the digits of the "radius" adjust display are flashing (as well in half a second timing pulse).
With this test you can check if the displays are working properly.
Please watch carefully if all seven segments of each digital display are working correctly.
Leave the indication test with "stop".

### 4. Input signal test

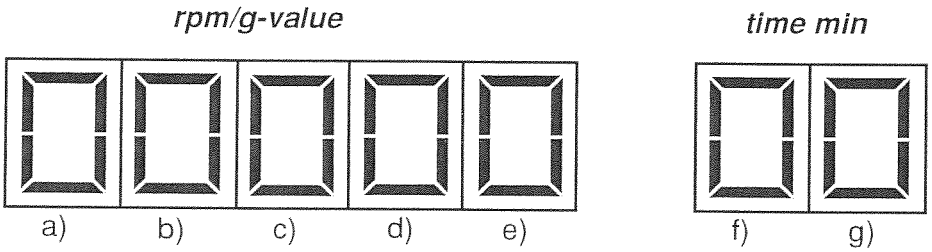
**Attention:**
During this self test it is possible that the motor is triggered uncontrolled by the converter. That means, that the motor could start turning without pressing the "run" button.
Please make sure that there is nothing in the rotor chamber during the self test, except of the rotor.

Take care of your fingers!

The input signal test is used to check the input signals imbalance, lid lock, motor temperature, speed, rotor identification and the input signal of the interface of the centrifuge control board.

Activate the self test program as described under point 1.
Press the key "lid" to activate the input signal test.

Then the letter "E" (standing for input) appears on the digital display for "brake". The inputs will be indicated on the digital displays for "rpm/g-value" and "time/radius".
If there is a "1" on the indication (fixed or flashing) it means that there is a signal or that the contact is closed .
If there is a "0" it means that there is no signal.




a) Imbalance

b) Lid lock

c) not occupied

d) Speed identification

e) Rotor identification (low speed)

f) Rotor identification (high speed)

g) Serial interface

**a) Imbalance**

The display "a" has to be "0". If you press the imbalance switch (see chapter 3.4/9) the display changes to "1".

**b) Lid lock**

With the centrifuge lid open the display "b" is "0". If you close the lid the indication has to show "1".

c) Not occupied

d) Speed identification

As long as the motor is out of action the indication "d" shows "0".
If the motor is turning the indication changes to "1".
Turn the motor by hand to check the sensor.

e,f) Rotor identification

The rotor identification sensor consists of two hall-effect sensors.
Due to that the indicator rings have two different diameters of code rings, but for each rotor only one of the rings are occupied (either inner or outer ring).
Depending on the rotor (high or low speed) the indication "e" or "f" shows a "1" when the rotor is turning.
Instead of using a rotor you can rub gently with a permanent magnet over the sensor. After doing that, the indication "e" and "f" also have to show "1".

g) Serial interface

For the interface test the lid must be closed.
The display "g" has to show "1".
This means that regarding the data flow between the operational control, the power board and the converter are o.k..
If the display shows "0":
- Defect at one of the above mentioned electronical components.
- Defect at a flat belt cable respectively directly at one of the interfaces.

Leave the input test with "stop".

## 5. Output test

Activate the self test program (as described under point 1).
Press key "quick" to start the output test. Then "A" appears on the display "brake".
With this test you can check the function of certain outputs by pressing different keys.

| Key | Function |
|---|---|
| quick | Starts the output test. The relay of the solenoid valve will be closed at the same time - solenoid valve open. |
| rpm/g-value | The frequency converter relay is switching. The green LED of the converter is lighting (for this function the centrifuge lid have to be closed). |
| time/radius | Not occupied for these models. |
| lid | Opens the centrifuge lid lock. |
| start | The compressor relay is switching. Compressor is working. |
| stop | This allows you to exit the output test. |

## 6. Indication of software version

Activate the self test program (as described under point 1).
Press the key "start". You can see the software version on the digital display "brake".

## 7. Adjustment of the operational control

Activate the self test program (as described under point 1).

The operational control has to be adjusted according to the centrifuge type where it is going to be used. Press key "store". On "speed/rcf" indication appears the centrifuge type for which the operational control is adjusted for. For this unit "513" has to appear. You can select centrifuge types by pressing keys "up" and "down". Press key "stop" to store your adjustment. Now the operational control shows the adjusted voltage (115 V or 220 V). You can select the voltage as well by pressing keys "up" and "down". Press key "stop" to store your adjustment. At the same time you leave the function "Adjustment of the operational control".

## 8. Motor run-in

By pressing the "Run" button for about 5 seconds you can invoke the program module "Motor run-in"
For a periode of 1 minute, the motor gets accelerated to 10% of the max. speed of the insert rotor. After each further minute the speed gets accelerated by 10 % until the max. speed is reached. In the time display the run-in time is indicated in minutes from 0 - 9.

**Attention:**
**The run-in is neccessary when the motor is replaced with a new one. The run-in is used to spread the grease in the bearing all around the ball bearings. A starting of the centrifuge to max. speed without the motor run-in can cause bearing damages at the new motor.**

## 9. Elapsed time indicator

Activate the self test program (as described under point 1).

Press the key "up". The attended time of the unit will be indicated on the actual display. The attended hours appear on indication "speed/rcf" and the minutes on indication "time/radius".

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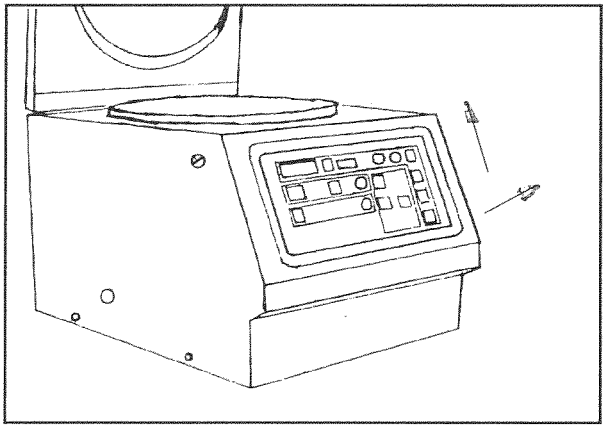
After doing any kind of assembling work, please make sure that all the protection grounded contacts are connected correctly.

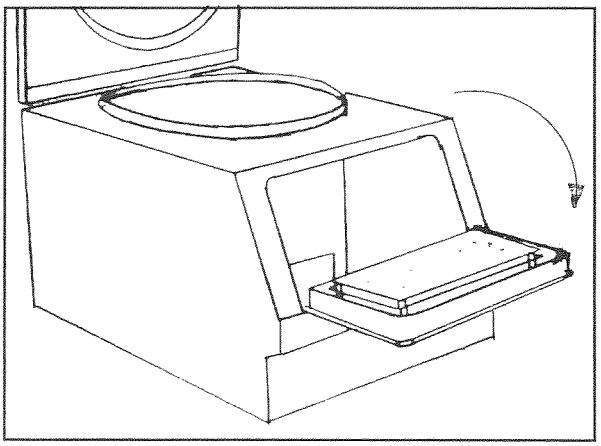
## 1. Exchanging of the operational control

- Push the frame of the operational control approx. 2 mm up (see sketch 1).
- Pull the lower part of the operational control out of the housing as shown in sketch 1.
- Tip it out of the front side sheet metal (see sketch 2).
- Unplug all electrical connections.
- Set in the new element in the front side sheet metal in reversed order.

**Attention: Make sure that the adjustment of the operational control is correct (see chapter 3.3/6).**



Sketch 1

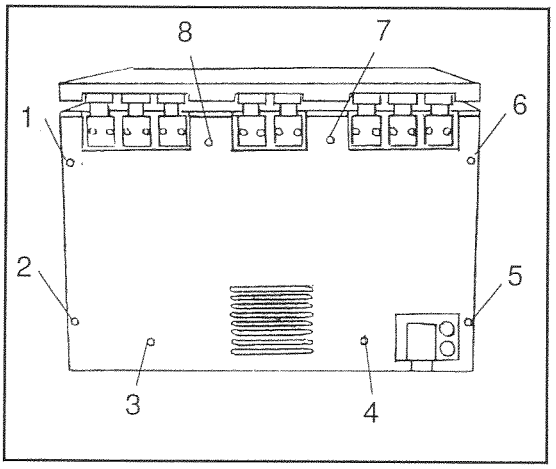


Sketch2

## 2. Dismounting of the centrifuge housing

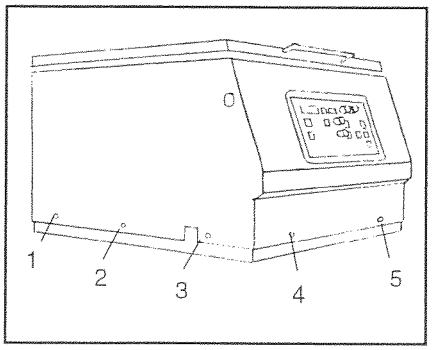
a) Back side sheet metal

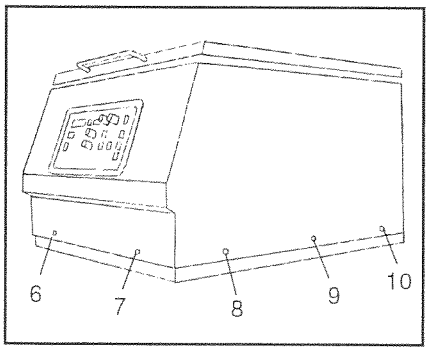
- Remove the screws 1 - 8 on the back side of the unit.
- Take off the back side sheet metal.
- Unplug the ground connection.



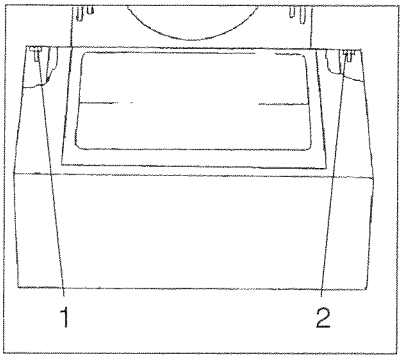

b) Housing

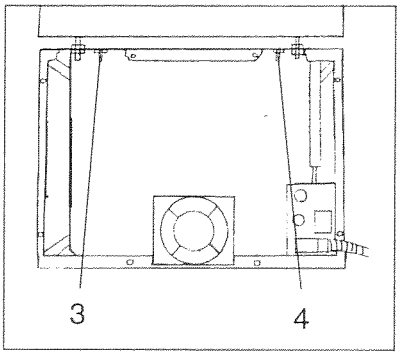
- Remove the operational control (point 1) and the back side sheet metal (point 2a).
- Remove screws 1 - 10 around the lower edge of the centrifuge.



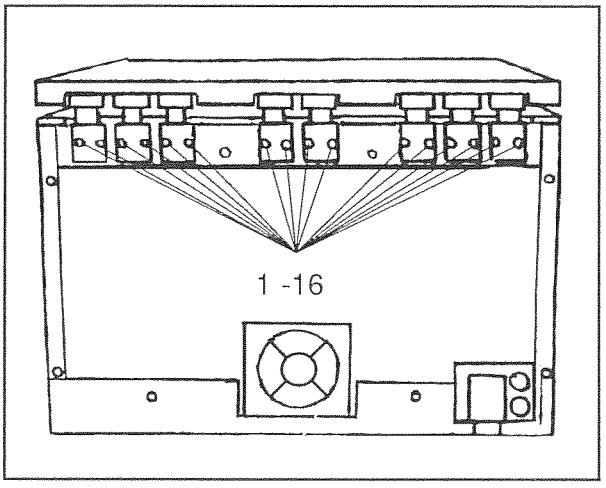
- Remove the nuts 1 and 4.
- Unplug the grounded wire of the housing.
- Lift up the housing.
- Reassemble the unit in the reversed order.



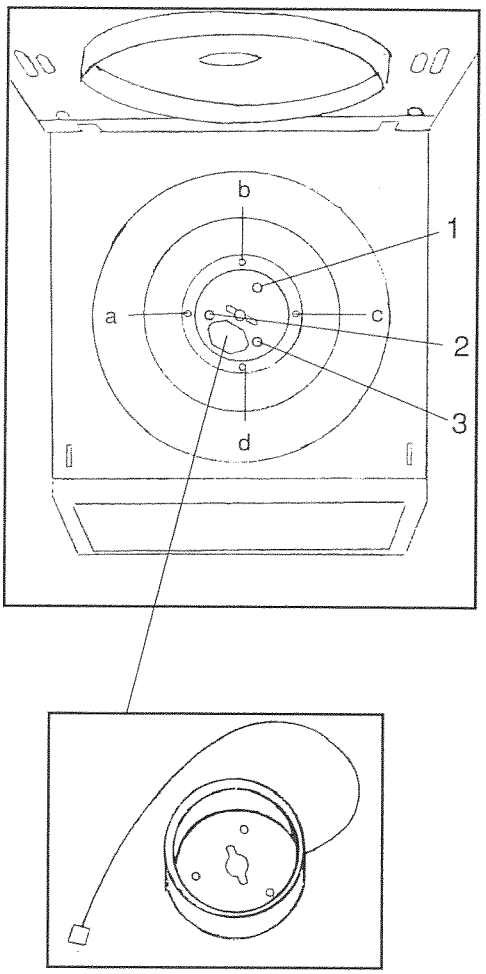

c) Lid

- Remove the back side sheet metal (as described under point 2a).
- Unlock the lid.
- Remove the screws 1 - 16 of the hinges.
- Pay attention to the fastening bar of the hinges at the inner side of the unit.
- Now the lid can be removed completely.
- Reasemble the lid in the reversed order.



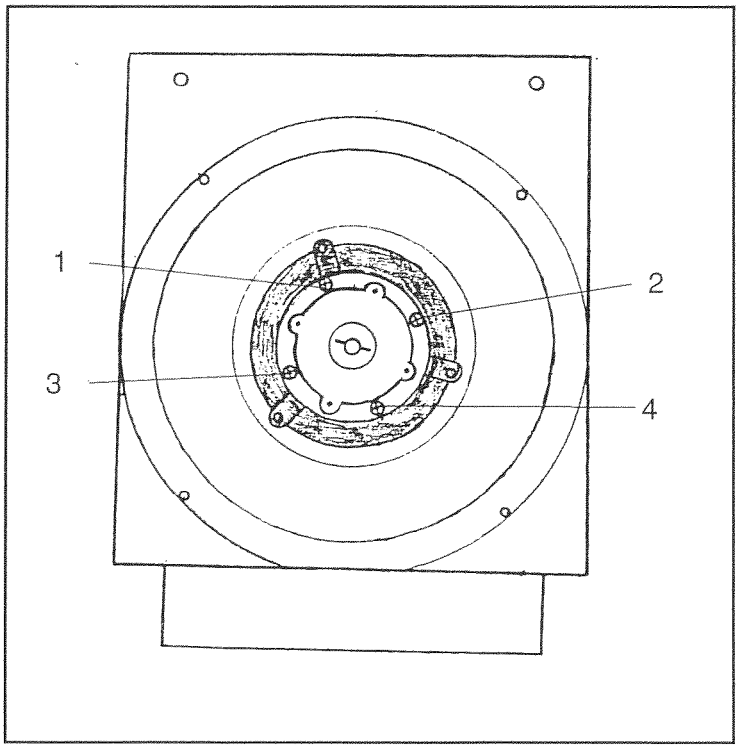
### 3. Exchanging of the rotor identification sensor

- Remove the operational control (point 1).
- Remove the centrifuge housing (point 2a - b).
- Take off the motor protection cover (screws a to c).
- Unplug the sensor cable at the power board.
- Release the flat head screws 1 - 3 of the sensor flange.
- Take the flange together with the sensor out of the unit.
  Take care of the sensor cable.
- Exchange the sensor with a new one.
- Reassemble the unit in reversed order.



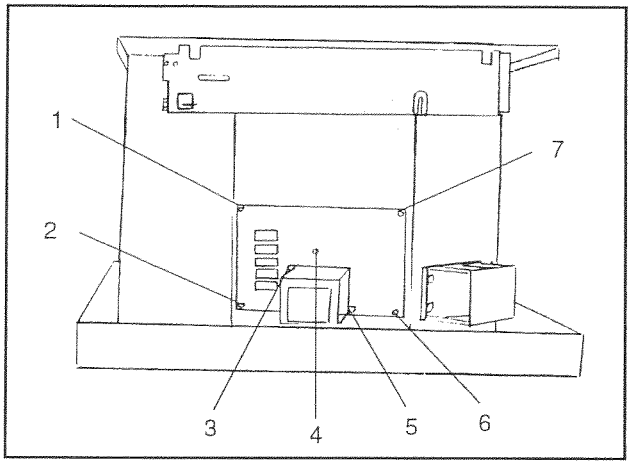
## 4. Exchanging of the motor

- Remove the operational control (as described under point 1)
- Remove the centrifuge housing (as described under point 2).
- Remove the rotor sensor (as described under point 3).
- Unplug the connection cables of the motor, you will find the location of the connectors in chapter 4.
- Remove screws 1 - 4 of the motor mount.
- Bind a pice of string to the conectors of the motor wires, this allows you to pull the wires of the new motor back through the holes in safty frame.
- Lift the motor out of the unit.
- Pay attention to the arrangement of the wiring when replacing the motor.
- Reassemble the unit in reversed order.



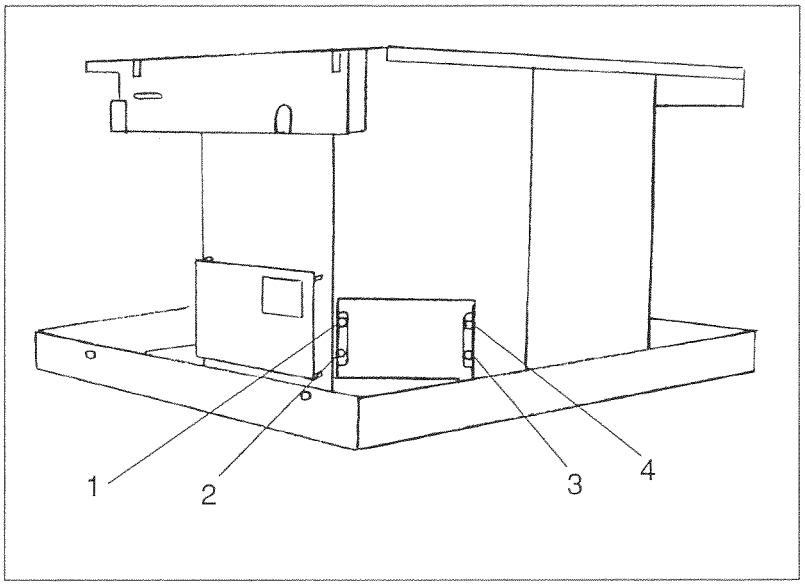
## 5. Exchanging of the power board

- Remove the operational control (point 1).
- Remove the centrifuge housing (point 2 a-b).
- Unplug all cable connections of the power board.
- Remove the screws 1 - 7.
- Reassemble the unit in reversed order.



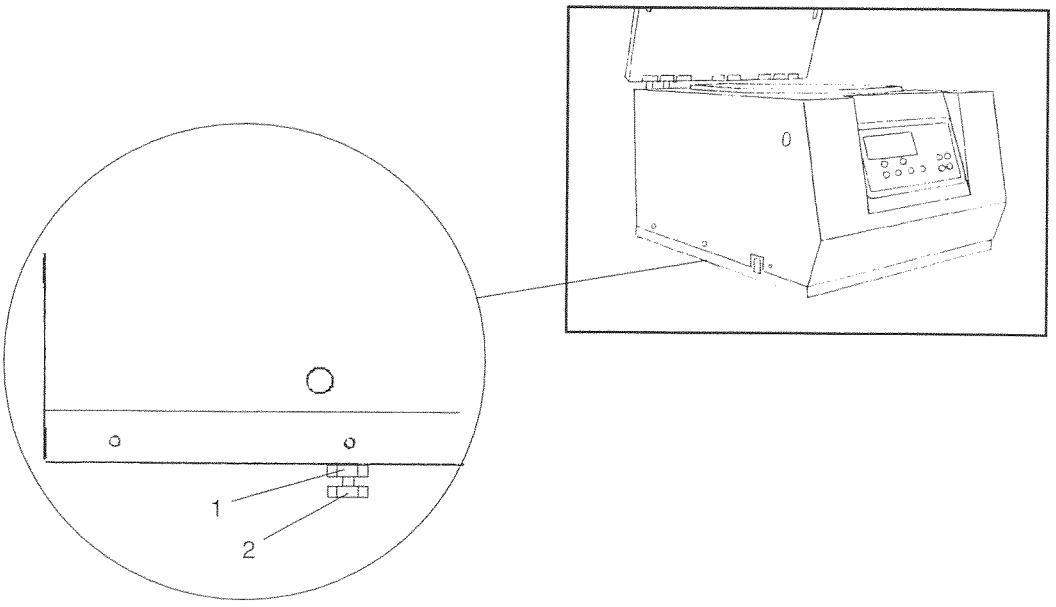
## 6. Exchanging of the frequency converter

- Remove the operational control (point 1).
- Remove the centrifuge housing (point 2 a-b).
- Unplug all cable connections of the frequency converter.
- Remove the screws 1 - 4 of the frequency converter and take it out of the unit.
- Attention, before you place the new frequency converter, you have to apply heat conduction paste on the seating.
- Reassemble the unit in reversed order.



## 9. Adjustment of the imbalance switch

- Insert a rotor in the centrifuge.
- Load one bore hole of the rotor with an imbalance switch off weight mentioned in the chart (see chapter 3.3/9). If a microlitre rotor is placed in the centrifuge you have to insert several adjacent reaction tubes.
- Start the centrifuge - the unit should switch off at the cut off speed mentioned in the chart (chapter 3.3/9) for the corresponding rotor.
- If the unit is not switching off you have to release the fixing nut (1). With the adjustment screw (2) you can adjust the imbalance switch off more sensitive (turn right).
- You can reach the screws from the left side at the bottom of the unit.
- If the unit is switching off, load the rotor with the allowed imbalance weight (see chapter 3.3/9).
- Start the centrifuge - the unit should not switch off again. If required, adjust the imbalance switch off with the adjustment screw (2) less sensitive.
- If you have to readjust the imbalance switch for the test with the allowed imbalance, you have to repeat the procedure with the imbalance switch off weight.



| Z 513 | | | |
|---|---|---|---|
| **Rotor No.** | **Cutoff speed** in rpm | **Allowed imbalance** in grams | **Cutoff imbalance** in grams |
| 220.70 V06 | 2000 | 13 | 15 |
| 220.70 V05 | 1960 | 15 | 16 |
| 220.29 V03 | 1960 | 14 | 16 |
| 220.41 V03 | 1930 | 15 | 17 |
| 220.78 V02 | 1900 | 49 | 51 |
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| 220.76 V02 | 1980 | 58 | 60 |
| | | | |

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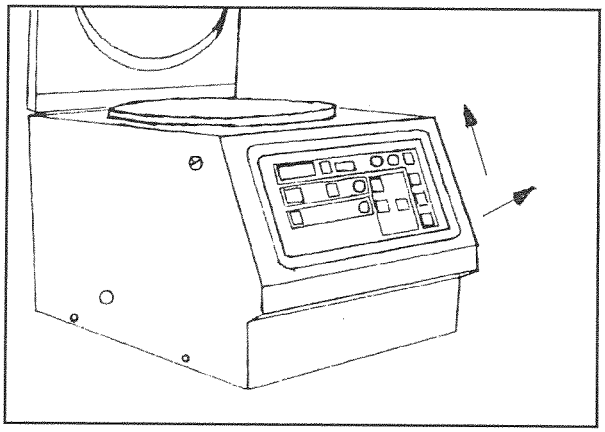
After doing any kind of assembling work, please make sure that all the protection grounded contacts are connected correctly.

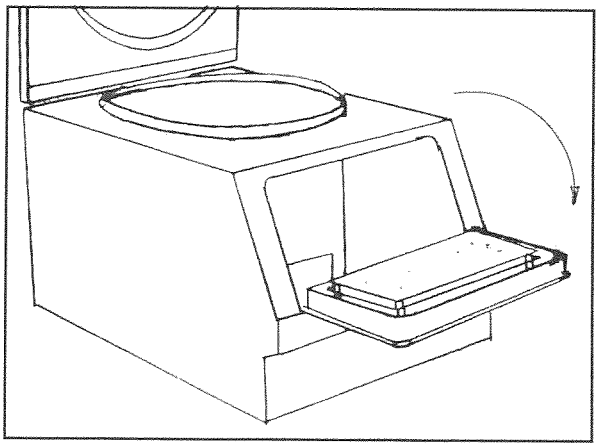
## 1. Exchanging of the operational control

- Push the frame of the operational control approx. 2 mm up (see sketch 1).
- Pull the lower part of the operational control out of the housing as shown in sketch 1.
- Tip it out of the front side sheet metal (see sketch 2).
- Unplug all electrical connections.
- Set in the new element in the front side sheet metal in reversed order.

**Attention: Make sure that the adjustment of the operational control is correct (see chapter 3.3/6).**



Sketch 1

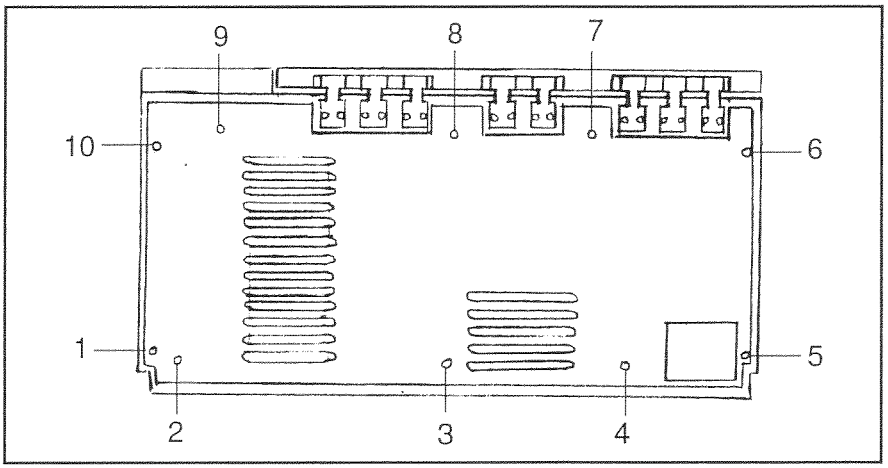


Sketch2

## 2. Dismounting of the centrifuge housing

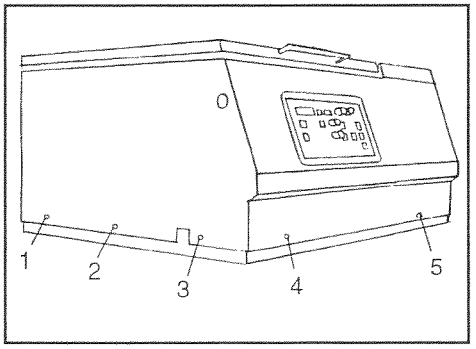
a) Back side sheet metal

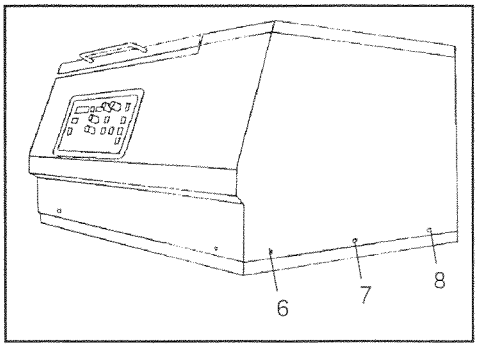
- Remove the screws 1 - 10 on the back side of the unit.
- Take off the back side sheet metal.
- Unplug the ground connection.



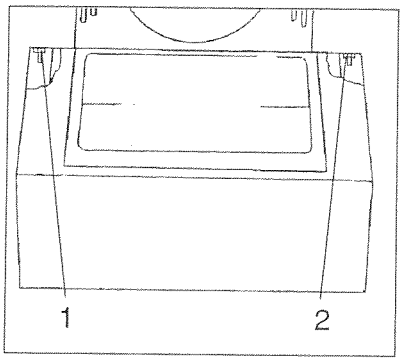

b) Housing

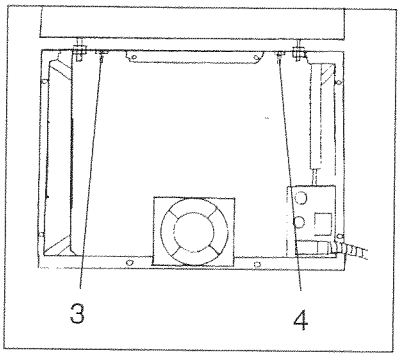
- Remove the operational control (point 1) and the back side sheet metal (point 2a).
- Remove screws 1 - 10 around the lower edge of the centrifuge.



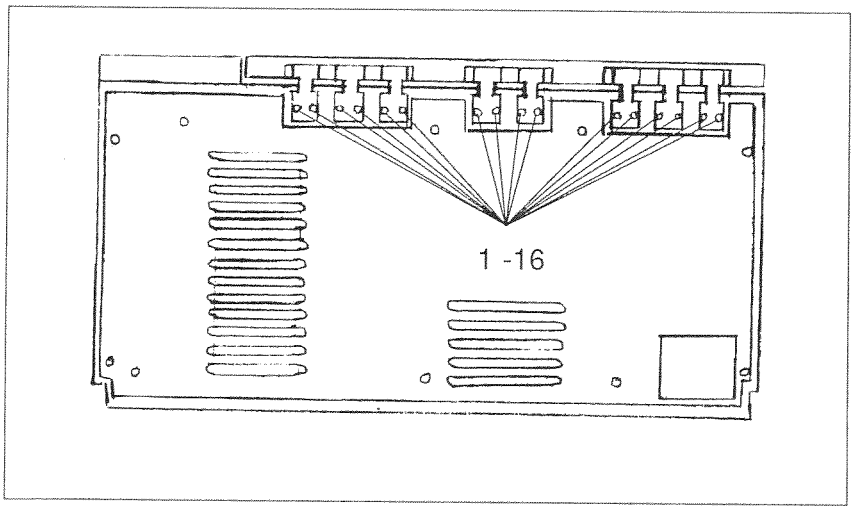
- Remove the nuts 1 and 4.
- Unplug the grounded wire of the housing.
- Lift up the housing.
- Reassemble the unit in the reversed order.




c) Lid

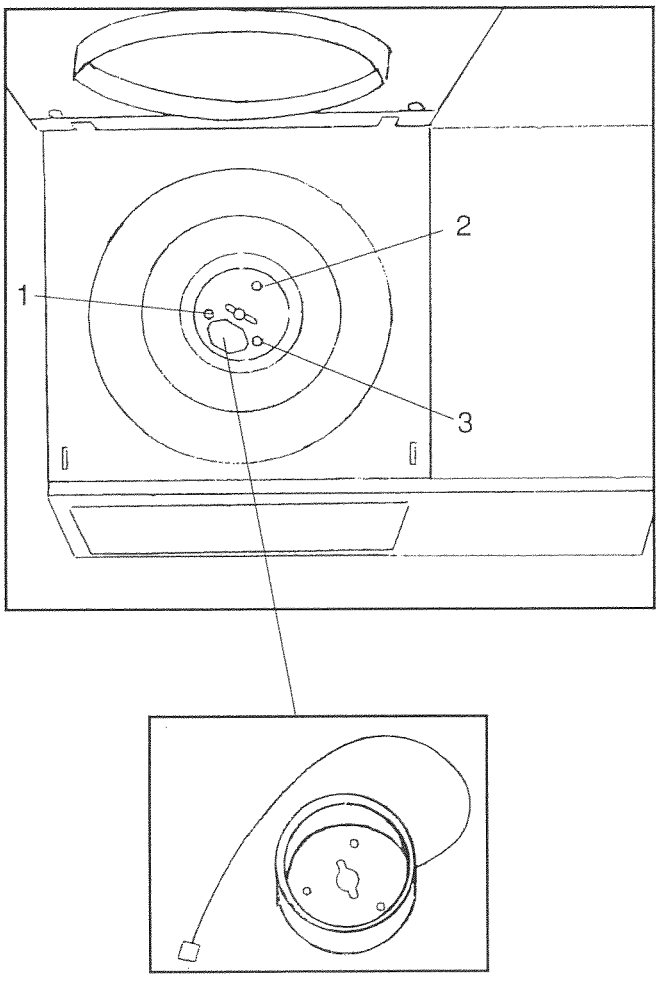
- Remove the back side sheet metal (as described under point 2a).
- Unlock the lid.
- Remove the screws 1 - 16 of the hinges.
- Pay attention to the fastening bar of the hinges at the inner side of the unit:
- Now the lid can be removed completely.
- Reasemble the lid in the reversed order.



### 3. Exchanging of the rotor identification sensor

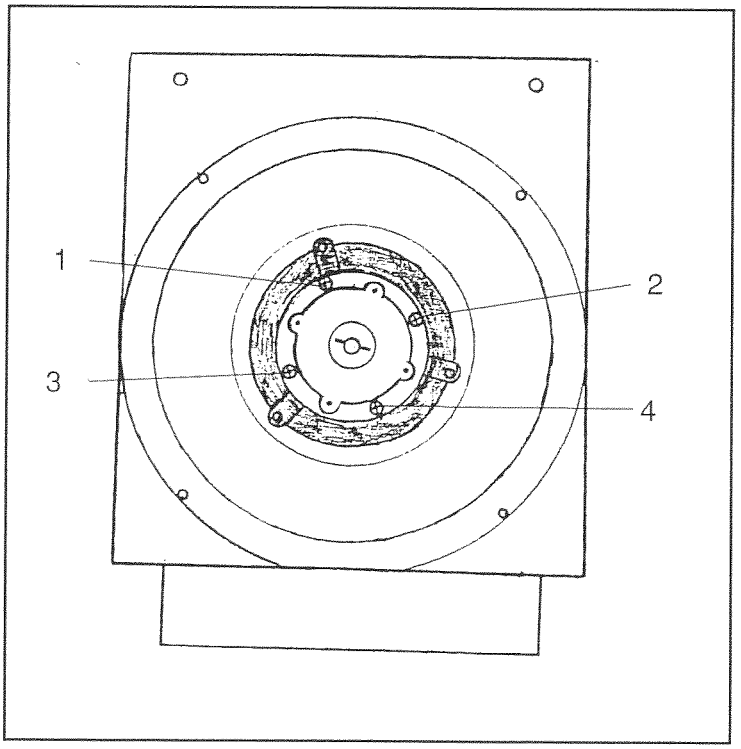
- Remove the operational control (point 1).
- Remove the centrifuge housing (point 2).
- Take off the rubber motor protection cover.
- Unplug the sensor cable at the power board.
- Release the flat head screws (1 - 3) of the sensor flange.
- Take the flange with the sensor out of the unit.
- Exchange it with a new one.
- Reassemble the unit in reversed order.

**Attention: Continue to apply pressure to the outer edge of the cover until it snaps into the position and grips onto the lip of the steel chamber. An airtight seal must be formed.**



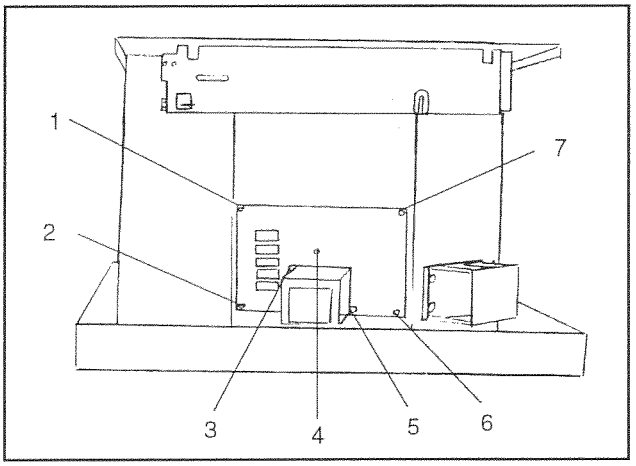
## 4. Exchanging of the motor

- Remove the operational control (as described under point 1)
- Remove the centrifuge housing (as described under point 2 a).
- Remove the rotor sensor (as described under point 3).
- Unplug the connection cables of the motor, you will find the location of the connectors in chapter 4.
- Remove screws 1 - 4 of the motor mount.
- Bind a pice of string to the conectors of the motor wires, this allows you to pull the wires of the new motor back through the holes in safty frame.
- Lift the motor out of the unit.
- Pay attention to the arrangement of the wiring when replacing the motor.
- Reassemble the unit in reversed order.



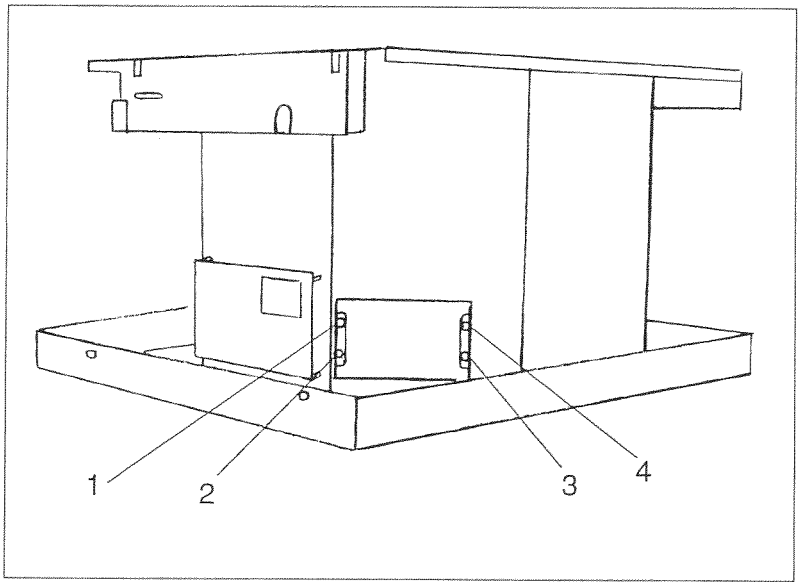
## 5. Exchanging of the power board

- Remove the operational control (point 1).
- Remove the centrifuge housing (point 2 a-b).
- Unplug all cable connections of the power board.
- Remove the screws 1 - 7.
- Reassemble the unit in reversed order.



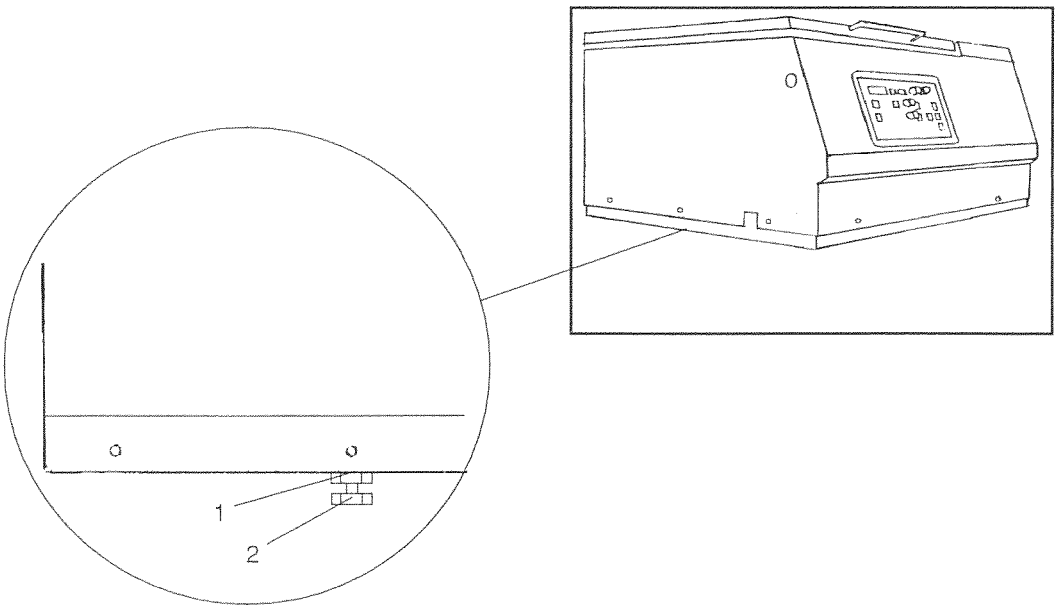
## 6. Exchanging of the frequency converter

- Remove the operational control (point 1).
- Remove the centrifuge housing (point 2 a-b).
- Unplug all cable connections of the frequency converter.
- Remove the screws 1 - 4 of the frequency converter and take it out of the unit.
- Attention, before you place the new frequency converter, you have to apply heat conduction paste on the seating.
- Reassemble the unit in reversed order.



## 9. Adjustment of the imbalance switch

- Insert a rotor in the centrifuge.
- Load one bore hole of the rotor with an imbalance switch off weight mentioned in the chart (see chapter 3.4/9). If a microlitre rotor is placed in the centrifuge you have to insert several adjacent reaction tubes.
- Start the centrifuge - the unit should switch off at the cut off speed mentioned in the chart (chapter 3.4/9) for the corresponding rotor.
- If the unit is not switching off you have to release the fixing nut (1). With the adjustment screw (2) you can adjust the imbalance switch off more sensitive (turn right).
- You can reach the screws from the left side at the bottom of the unit.
- If the unit is switching off, load the rotor with the allowed imbalance weight (see chapter 3.4/9).
- Start the centrifuge - the unit should not switch off again. If required, adjust the imbalance switch off with the adjustment screw (2) less sensitive.
- If you have to readjust the imbalance switch for the test with the allowed imbalance, you have to repeat the procedure with the imbalance switch off weight.



| Z 513 K | | | |
|---|---|---|---|
| **Rotor No.** | **Cutoff speed** in rpm | **Allowed imbalance** in grams | **Cutoff imbalance** in grams |
| 220.70 V06 | 1920 | 13 | 15 |
| 220.70 V05 | 1950 | 14 | 16 |
| 220.29 V03 | 1960 | 14 | 16 |
| 220.41 V03 | 1930 | 15 | 17 |
| 220.78 V02 | 1920 | 35 | 37 |
| 220.80 V02 | 1900 | 38 | 40 |
| 220.76 V02 | 1920 | 42 | 44 |
| | | | |

# Content


| | | Chapter |
|---|---|---|
| 1. | Functional description of the refrigeration system | 3.6/1 |
| 2. | Keyplan of the refrigeration system | 3.6/2 |
| 3. | Emptying and filling with Freon | 3.6/3 |
| 4. | Lowest temperatures (depending on the rotor) | 3.6/5 |

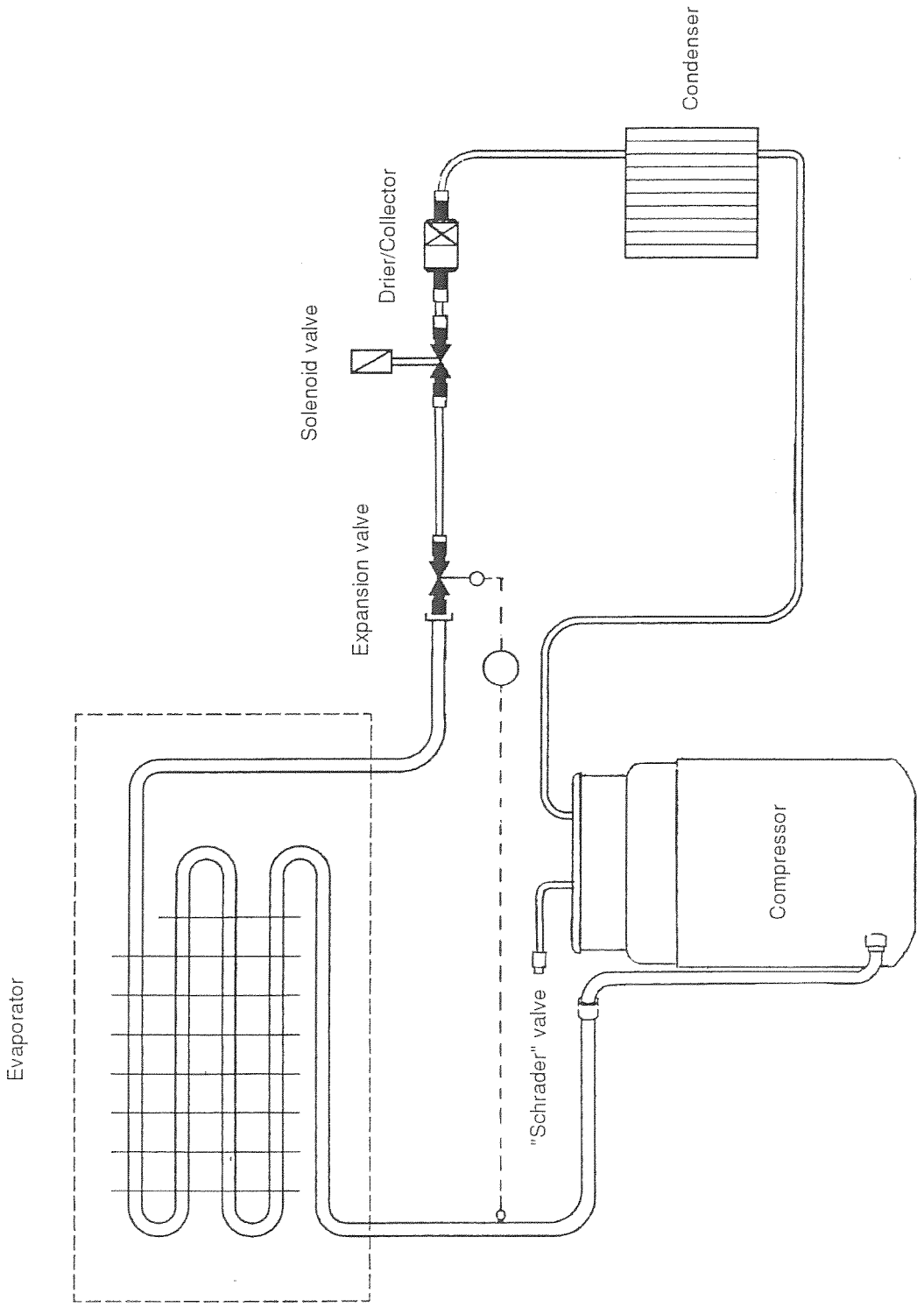
## 1. Functional description of the refrigeration system

The quantity of the coolant passed into the evaporator is controlled by a solenoid valve and an expansion valve. A detecting element continuously measures the temperature at the evaporator output. This detecting element regulates the injection nozzle, because of this the evaporator gets always the neccessary quantity of coolant. So you can reach the maximum capability of the refrigeration system at any operating status.

As soon as the required preset temperature is reached, the solenoid valve interrups the coolant circuit. The solenoid valve reopens the circuit as soon as the temperature rises and passes on coolant to the evaporator again.

The response time of the solenoid valve is controlled by the CPU.
From the temperature sensor, placed in the rotor chamber, the processor receives the information of the chamber temperature.
As the actual temperature of the samples is not necessarily the same as the chamber temperature, the microprocessor calculates the sample temperature for the respective rotor.
This value will be indicated on the digital temperature display. The temperature control of the microprocessor works according to the calculated value.
Therefore the user can select the required sample temperature (± 1° C). Samples cannot be damaged by discrepancies between chamber temperature and sample temperature.

## Keyplan of the refrigeration system



## 3. Emptying and filling with coolant (R134a)

For doing this work you have to have the following equipment:
Coolant suction implement with collecting tank, vacuum pump, vacuum measuring instrument, quantity measuring system for the freon and a manometer combination.

a) Emptying of the refrigeration system

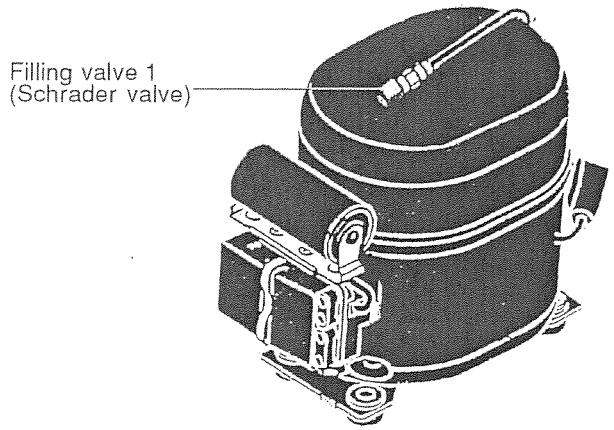
- Remove the housing parts until the refrigeration system is self-contained (see chapter 3.5).
- Connect the front panel back to the system, so that the unit can work without housing.
- Connect the coolant suction implement with the valve (see sketch, chapter 3.6/4).
- Start the self test program and choose test range 4 (output test) - solenoid valve open.
- Evacuate the coolant from the system.
- Now you can carry out the necessary repair work on the refrigeration system.

b) Filling of the refrigeration system

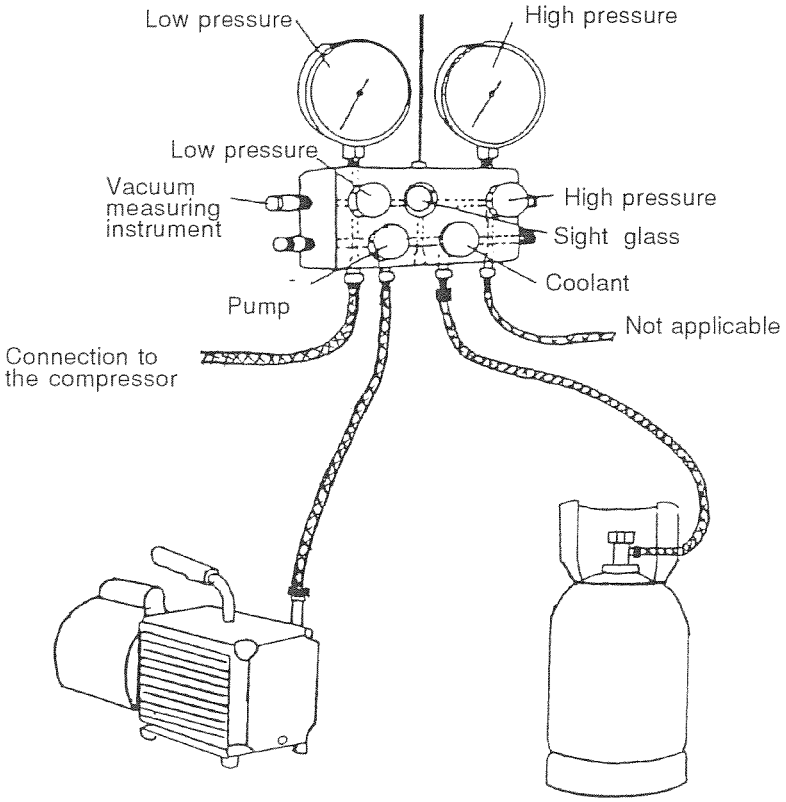
- Connect the vacuum pump, the manometer combination and the coolant bottle (R 134) to the valve (1), (see sketch, chapter 3.6/4).
- Start the self test program and choose test range 4 (output test) - solenoid valve open.
- Evacuate the refrigeration system for approx. 30 min..
- Switch off the vacuum pump.
- Make sure that the system remains in a state of vacuum.
  If not, the system is leaking.
- Fill up the system with 800 grams coolant R134a.
- Check all tube connections very closely with a leak indicator.

**Attention: Only use R134a.**
**Filling quantity must never exceed 850 g.**

## Sketch: Compressor, Filling valve 1




## Sketch: Manometer combination, vacuum pump, coolant bottle



| Rotor No. | speed in rpm | Lowest sample temperature |
|---|---|---|
| 220.70 V06 | 5000 | + 8° C |
| 220.70 V05 | 3600 | +10° C |
| 220.29 V03 | 3200 | - 5° C |
| 220.41 V03 | 2000 | - 5° C |
| 220.78 V02 | 15000 | + 5°C |
| 220.80 V02 | 15000 | + 2°C |
| 220.76 V02 | 15000 | + 0 °C |
| | | |

Ambient temperature 23° C

The absolute end temperatures can be subject to fluctuations of ± 2° C of the cooling compressor due to output variations.
The lowest sample temperatures depends on the ambient temperature.
If the ambient temperature increases, the lowest sample temperature that can be reached, increases as well.

# Contents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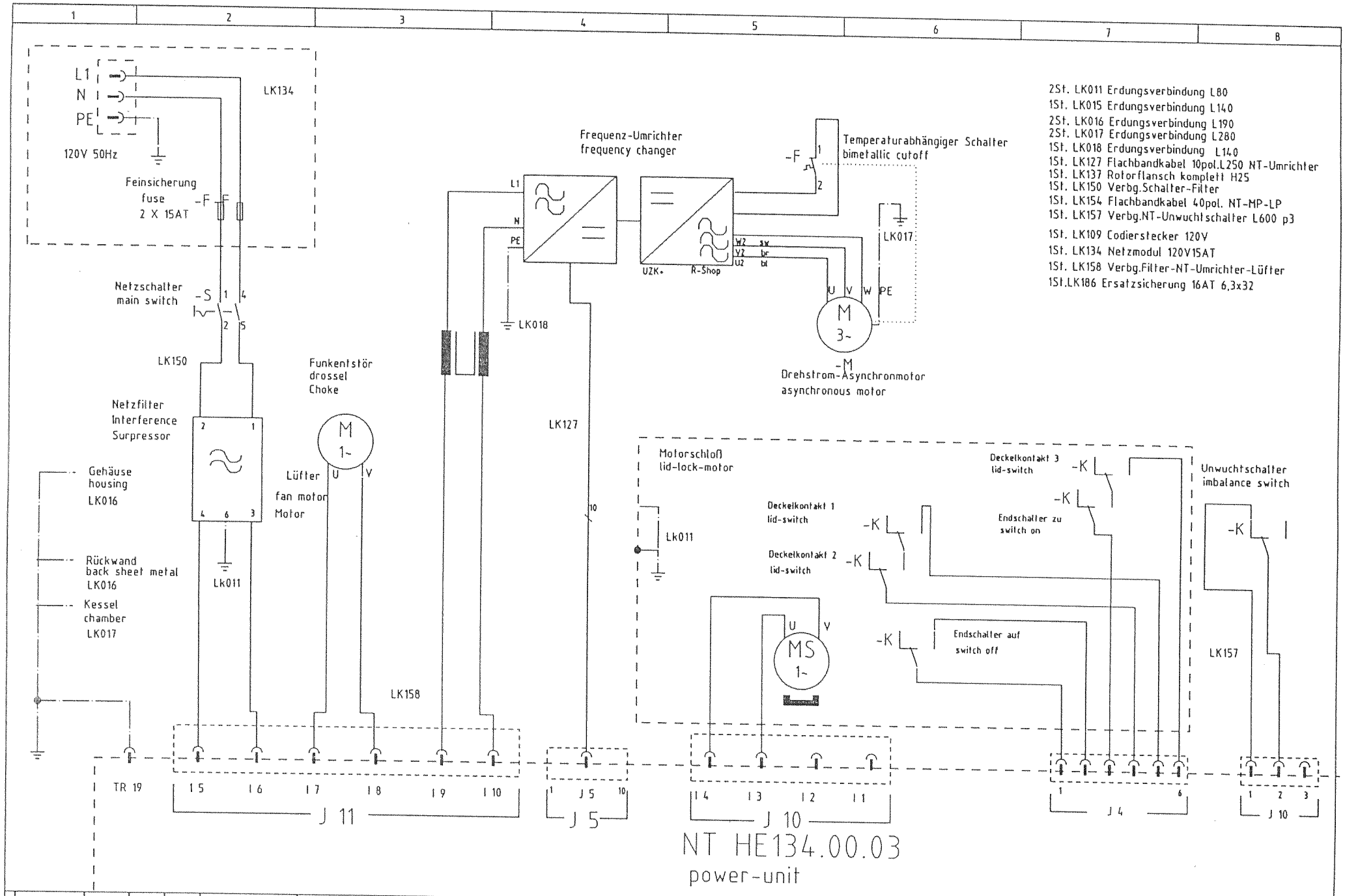
| Wiring Diagram | Z 513, 120 V | LS 0173 |
| Plan of electric installation | Z 513, 120 V | LS 0174 |
| Wiring Diagram | Z 513, 230 V | LS 0166 |
| Plan of electric installation | Z 513, 230 V | LS 0167 |
| Wiring Diagram | Z 513 K, 230 V | LS 0169 |
| Plan of electric installation | Z 513 K, 230 V | LS 0170 |

| | |
|---|---|
| Circuit diagram, power board | HE 121.00.03 |
| Layout, power board | HE 121.00.03 |
| Layout, control board 26KM | 271.01.02.02 |
| Layout, control board 26KMR | 271.01.12.02 |

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| | Änderung | Datum | Name | Norm | | Ersatz durch: | Ersatz für: | Ursprung: | |

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wiring-diagram
Stromlaufplan 120V 50/60Hz

LS 0200

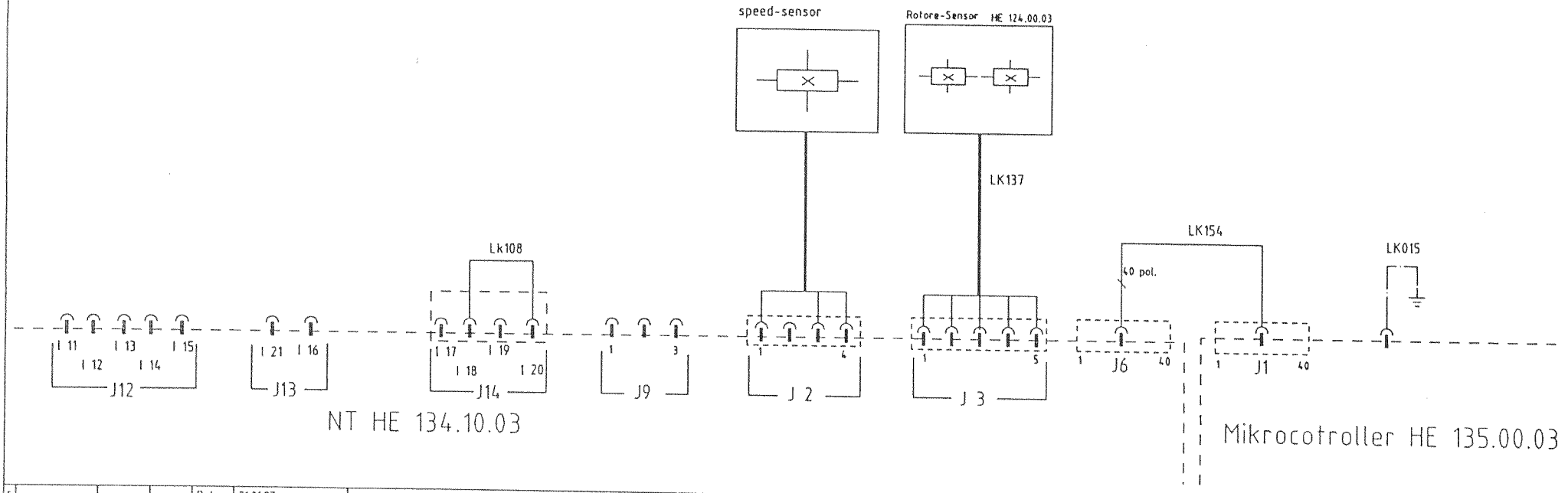
274-00V02 Z513

Blatt 3
Bl.

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|

2St. LK011 Erdungsverbindung L80
1St. LK015 Erdungsverbindung L140
2St. LK016 Erdungsverbindung L190
2St. LK017 Erdungsverbindung L280
1St. LK018 Erdungsverbindung L140
1St. LK127 Flachbandkabel 10pol.L250 NT-Umrichter
1St. LK137 Rotorflansch komplett H25
1St. LK150 Verbg.Schalter-Filter
1St. LK154 Flachbandkabel 40pol. NT-MP-LP
1St. LK157 Verbg.NT-Unwuchtschalter L600 p3

1St. LK108 Codierstecker 230V
1St. LK128 Netzmodul 230V16A
1St. LK156 Verbg.Filter-NT-Umrichter-Lüfter-Schütz
1St.LK185 Ersatzsicherung 16AT 5x20

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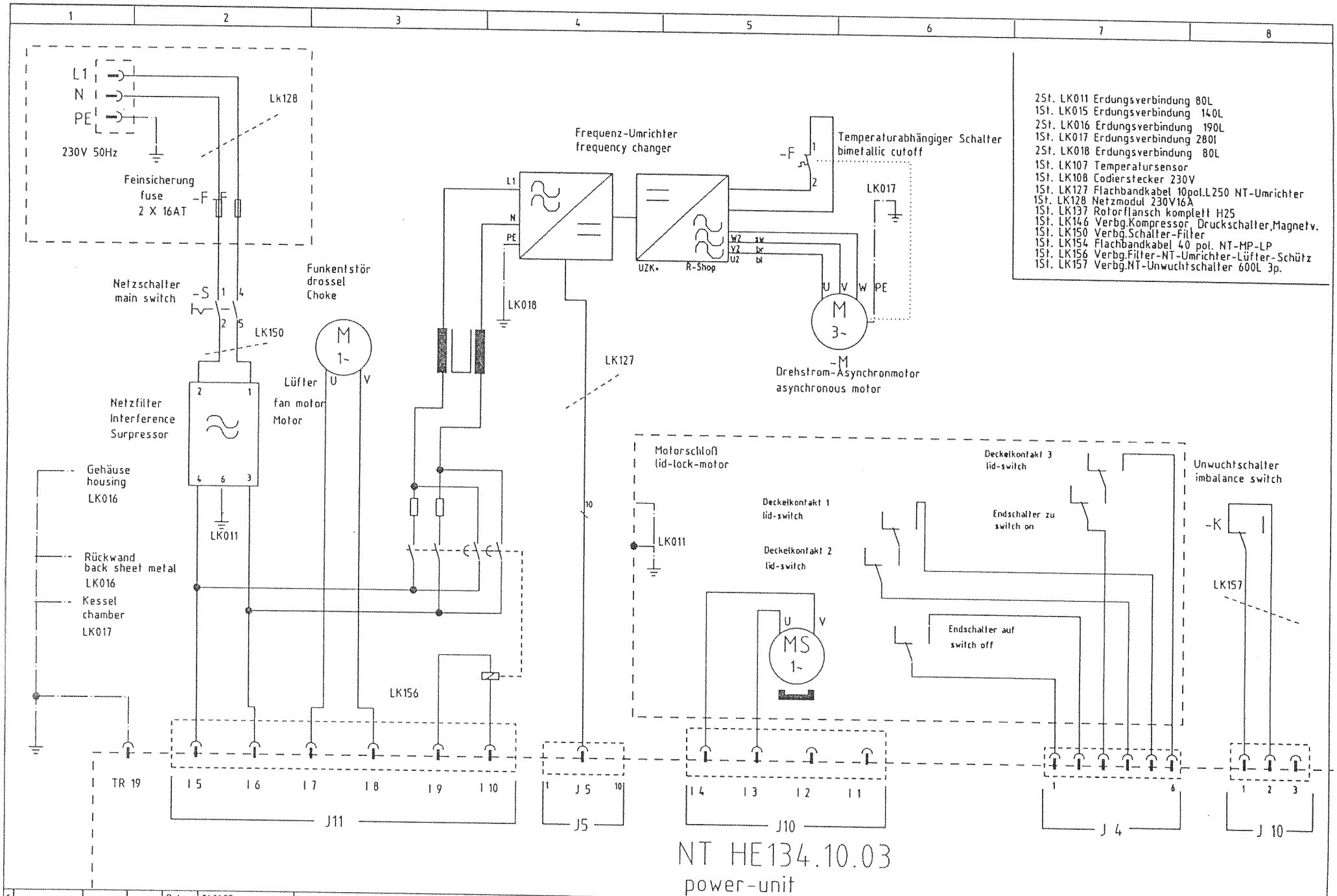


2St. LK011 Erdungsverbindung 80L
1St. LK015 Erdungsverbindung 140L
2St. LK016 Erdungsverbindung 190L
1St. LK017 Erdungsverbindung 280l
2St. LK018 Erdungsverbindung 80L
1St. LK107 Temperatursensor
1St. LK108 Codierstecker 230V
1St. LK127 Flachbandkabel 10pol.L250 NT-Umrichter
1St. LK128 Netzmodul 230V16A
1St. LK137 Rotorflansch komplett H25
1St. LK146 Verbg.Kompressor Druckschalter,Magnetv.
1St. LK150 Verbg.Schalter-Filter
1St. LK154 Flachbandkabel 40 pol. NT-MP-LP
1St. LK156 Verbg.Filter-NT-Umrichter-Lüfter-Schütz
1St. LK157 Verbg.NT-Unwuchtschalter 600L 3p.

# NT HE134.10.03

power-unit

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| c | | | | Datum | 21.01.97 | HERMLE Labortechnik GmbH TEL.:07426/9622-0 | wiring-diagram | LS 0198 | * |
| b | | | | Bearb. | jf | | | | * |
| a | | | | Gepr. | | | Stromlaufplan 230V50/60Hz | | |
| | Änderung | Datum | Name | Norm | | Ersatz durch: / Ersatz für: / Ursprung: | | 277-00V01 Z513K | Blatt 3 Bl. |

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1St. LK015 Erdungsverbindung L140
2St. LK016 Erdungsverbindung L190
2St. LK017 Erdungsverbindung L280
1St. LK018 Erdungsverbindung L140
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1St. LK150 Verbg.Schalter-Filter
1St. LK154 Flachbandkabel 40pol. NT-MP-LP
1St. LK157 Verbg.NT-Unwuchtschalter L600 p3
1St. LK109 Codierstecker 120V
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1St. LK158 Verbg.Filter-NT-Umrichter-Lüfter
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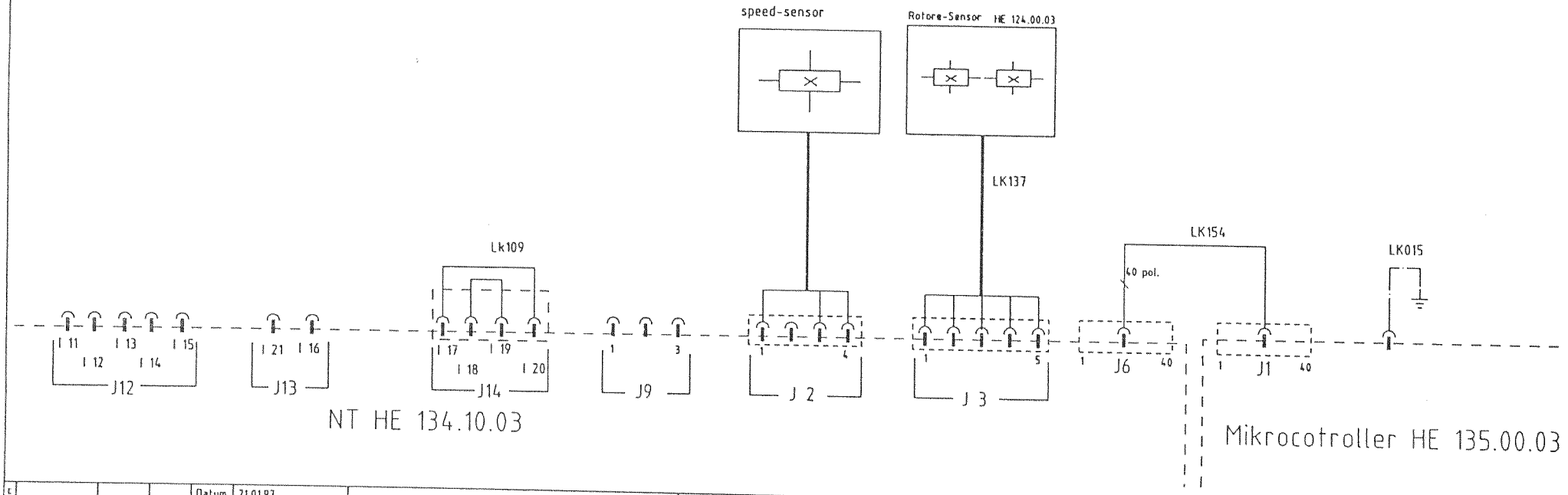


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| | Änderung | Datum | Name | Norm | | Ersatz durch: | Ersatz für: | Ursprung: |

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wiring-diagram
Stromlaufplan 120V 50/60Hz

LS 0200

274-00V02 Z513

Blatt 4
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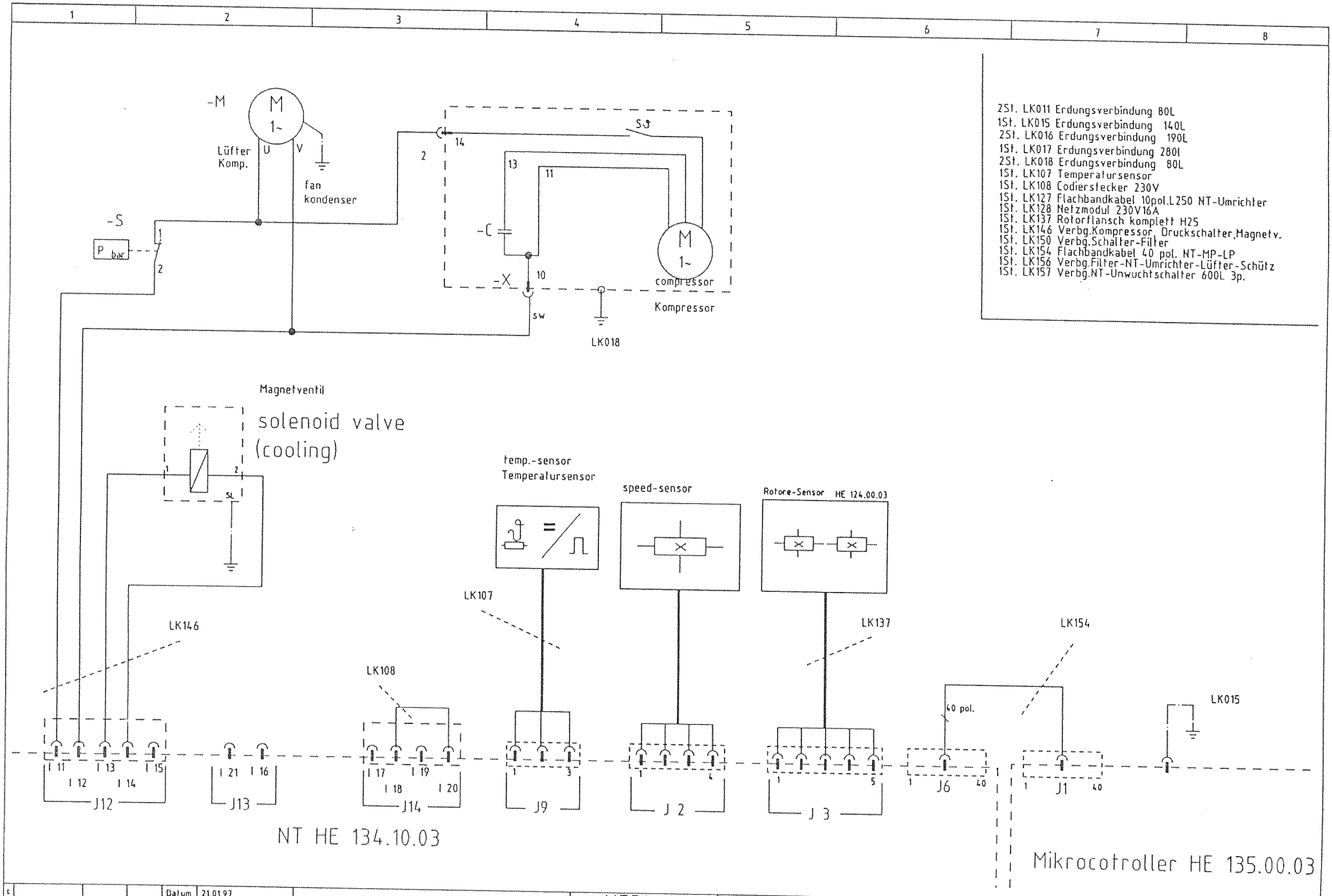


2St. LK011 Erdungsverbindung 80L
1St. LK015 Erdungsverbindung 140L
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Ursprung:

wiring diagram
Stromlaufplan 230V50/60Hz

LS 0198

277-00V01 Z513K

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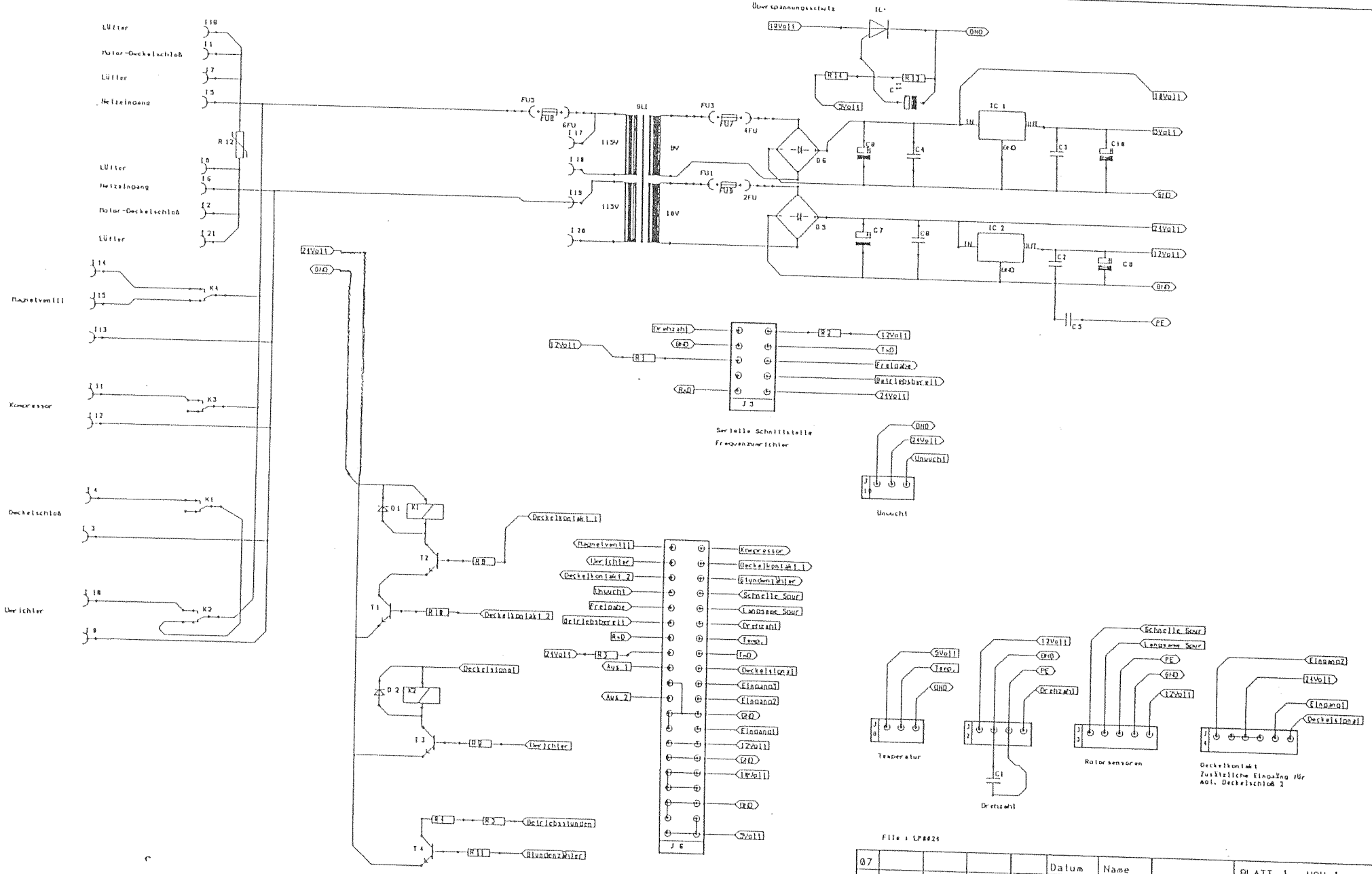


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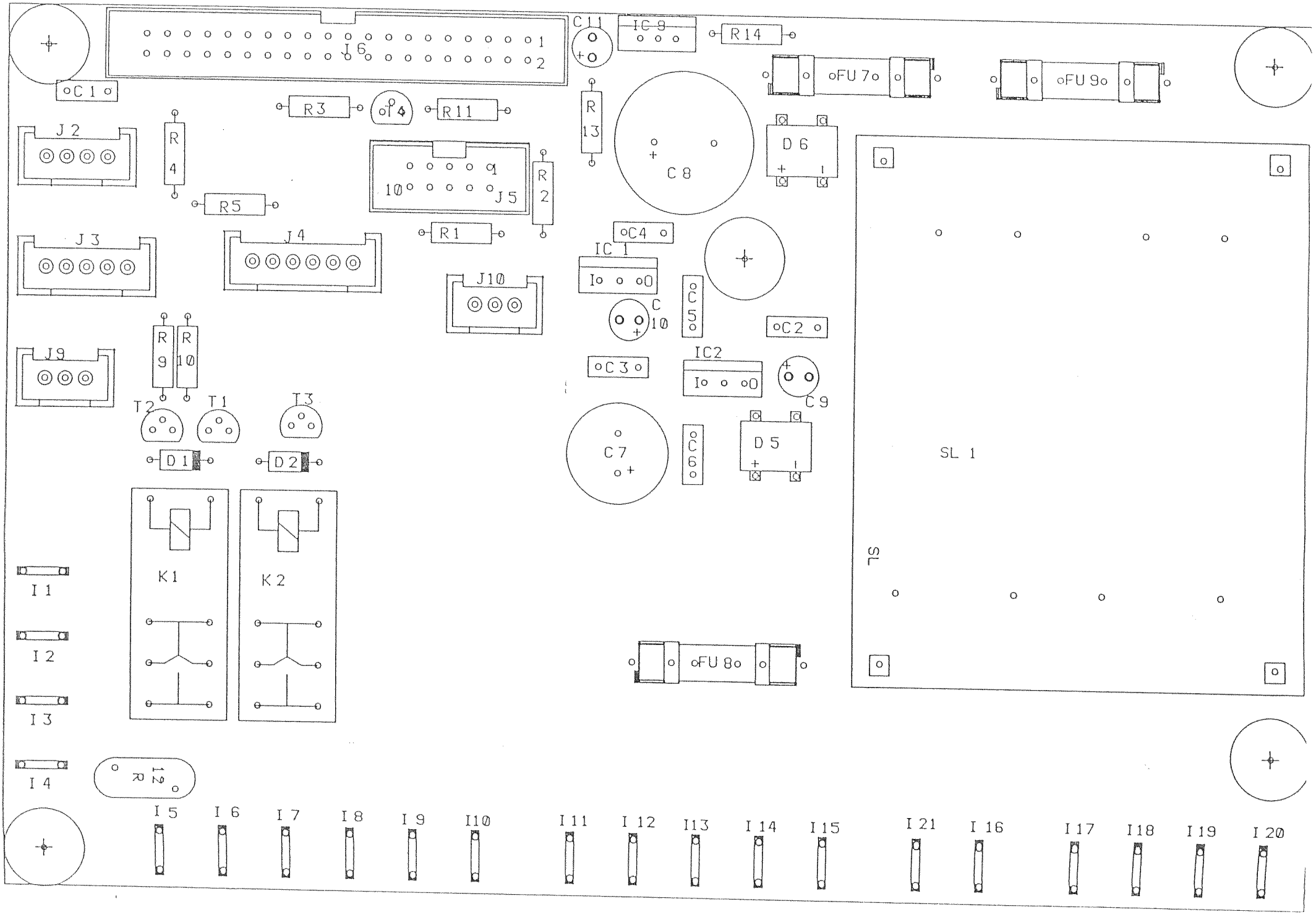
Hermle
LaborTechnik GmbH
Gosheimerstrasse 56
78564 Wehingen

BLATT 1 VON 1

BEZEICHNUNG
Netzteilplatine HE134.00.03

TEILENUMMER
HE 134.00.03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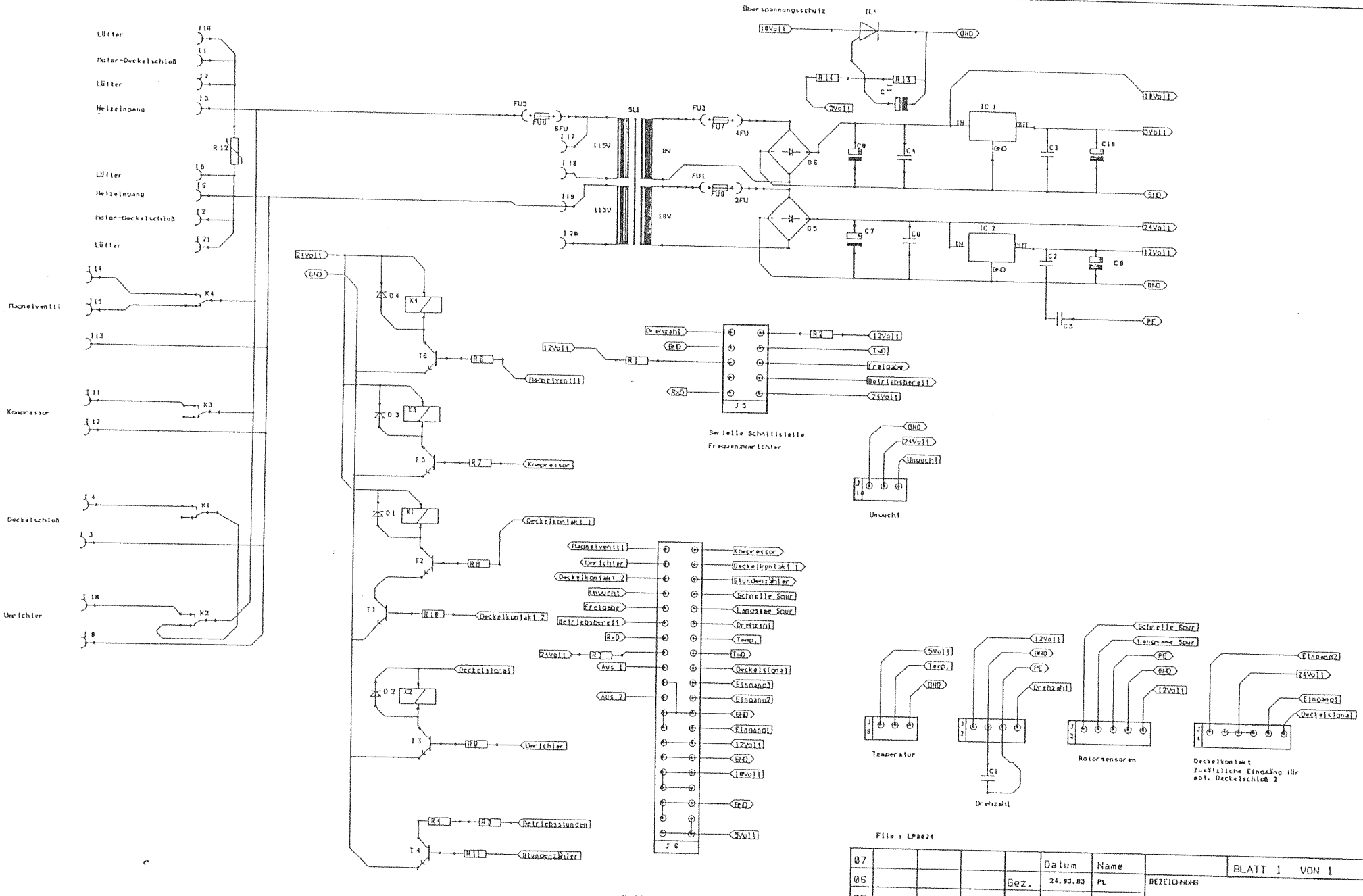
I 19
I 20




| | | | | | Datum | Name |
|---|---|---|---|---|---|---|
| 07 | | | | Gez. | 24.05.03 | PL |
| 06 | | | | Ged. | | |
| 05 | | | | | | |
| 04 | | | | | | |
| 03 | | | | | | |
| 02 | | | | | | |
| 01 | | 17.10.03 | PI | | | |
| | Ä.Nr. | Dat. | Name | | | |

Hermle
LaborTechnik GmbH
Gosheimerstrasse 56
78564 Wehingen

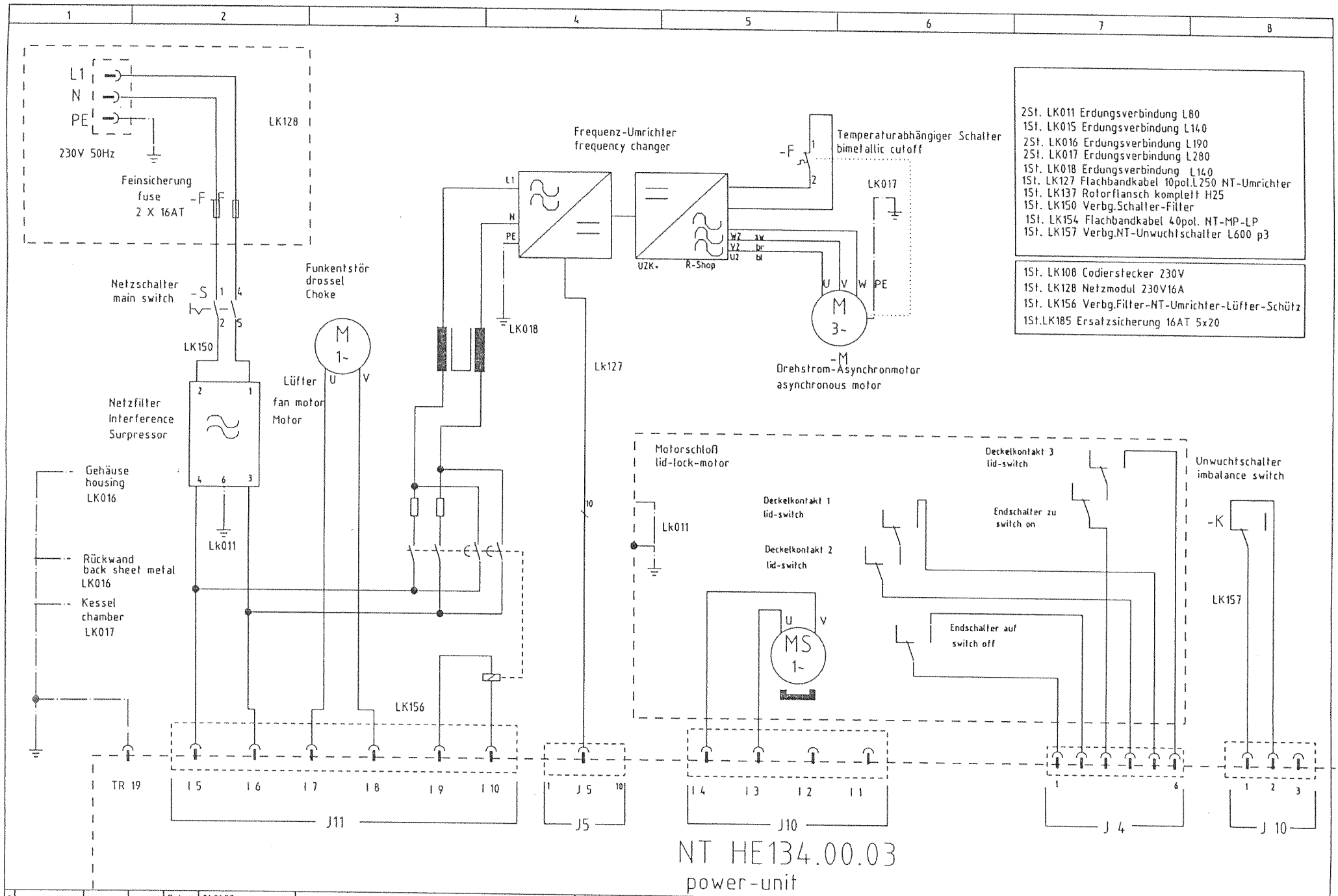
BLATT 1 VON 1

BEZEICHNUNG

Netzteilplatine

TEILENUMMER

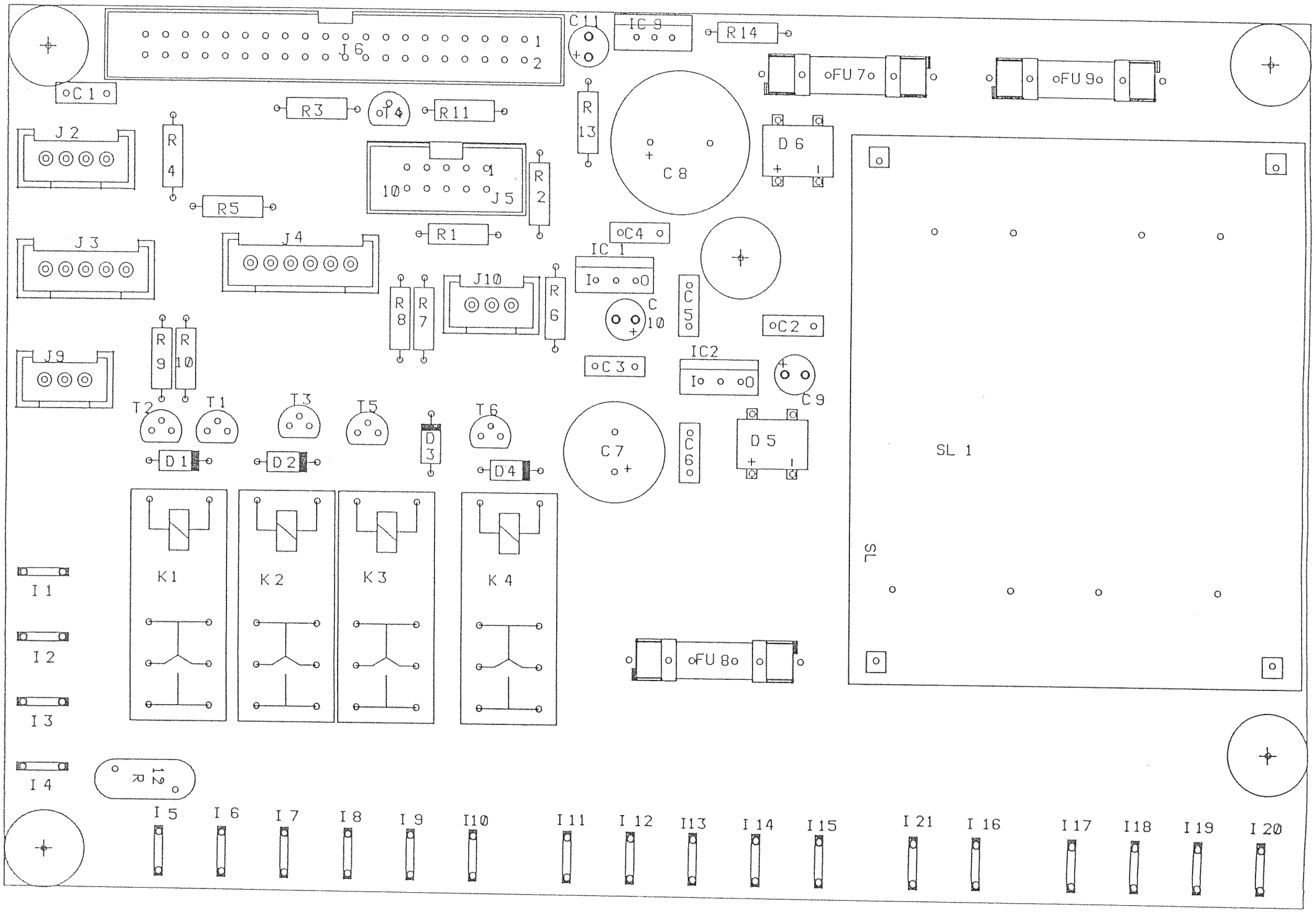
HE 134.10.03




# NT HE134.00.03
power-unit

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| c | | | | Datum | 21.01.97 | HERMLE Labortechnik GmbH TEL.:07426/9622-0 | wiring-diagram | LS 0199 | |
| b | | | | Bearb. | jf | | Stromlaufplan 230V 50/60Hz | | |
| a | | | | Gepr. | | | | | |
| | Änderung | Datum | Name | Norm | | Ersatz durch: | Ersatz für: | Ursprung: | 274-00V01 Z513 | Blatt 3 Bl. |

HE 134.10.03


J6
1
2
C11
IC 9
R14
FU 7
FU 9
C1
R3
4
R11
R13
C 8
D 6
J 2
R4
R5
J5
10
1
R2
R1
J 3
J 4
C4
IC 1
J10
R8
R7
R6
C50
C10
C2
J9
R9
R10
IC2
C3
C9
T2
T1
T3
T5
T6
D3
C 7
C60
D 5
SL 1
D 1
D 2
D 4
K1
K2
K3
K 4
SL
I 1
I 2
I 3
I 4
FU 8
12
R
I 5
I 6
I 7
I 8
I 9
I10
I 11
I 12
I13
I 14
I 15
I 21
I 16
I 17
I 18
I 19
I 20

# PREFACE

These error messages can help the service personnel to locate defects faster is they occur.
The diagnoses listed in this chapter are not necessarily accurate. They are theoretical defects that can occur and appropriate solutions. Please always make your own diagnosis with the help to the self test program.

Please always inform us about any type of defect you find and which is not mentioned in this chapter.
Only with your help we are able to improve and complete our service manual.

Thanks in advance for your help.

Hermle Labortechnik GmbH

## 1. Description of the error message system

The error message will be indicated by a certain number on the digital speed display. At the same time "ERROR" appears on the preset display.

Error Nr. 1 - 49 (Forced stop)

If one of the above errors occurs, the rotor will be braked from the preset speed to 0. As soon as the rotor has stopped, the error message can be reset by opening and closing the centrifuge lid.

Error Nr. 50 - 99 (Emergency stop)

If this occurs, the frequency converter will be switched off and the rotor will be coast to a stop. The error message can only be reset by switching the main switch off and on.

If the unit stops due to an error indication you should restart the unit to check if the error occurs again.

The error numbers which are not listed in this chapter are not in use at the time of publication and they are reserved for future use in broadening the error recognition program.

**Error no.: 1 Imbalance**

| | |
|---|---|
| *Reason:* | *Incorrect loading of the rotor* |
| Action: | Balance your samples |

| | |
|---|---|
| *Reason:* | *Incorrect adjustment of the imbalance switch* |
| Action: | Readjust imbalance switch according to chapter 3 |

**Error no.: 2 Permanent imbalance signal**

| | |
|---|---|
| *Reason:* | *Parting at the imbalance signal cable* |
| Action: | Repair parting of the cable |

| | |
|---|---|
| *Reason:* | *Position of the imbalance switch not correct* |
| Action: | Readjust imbalance switch |

| | |
|---|---|
| *Reason:* | *Imbalance switch is defective* |
| Action: | Replace the imbalance switch and readjust it |

**Error no.: 10 Overtemperature in the rotor chamber (more than 50°C)**

| | |
|---|---|
| *Reason:* | *Failure of the refrigeration system* |
| Action: | Check the refrigeration system and repair it |

| | |
|---|---|
| *Reason:* | *Temperature sensor defective* |
| Action: | Replace temperature sensor |

**Error no.: 11 Temperature sensor**

| | |
|---|---|
| *Reason:* | *Short circuit at the temperature sensor* |
| Action: | Replace temperature sensor |

**Error no.: 20 No rotor identification**

| | |
|---|---|
| *Reason:* | *No rotor inserted* |
| Action: | Insert rotor into the unit |

| | |
|---|---|
| *Reason:* | *Rotor identification sensor defective* |
| Action: | Replace identification sensor |

| | |
|---|---|
| *Reason:* | *Inserted rotor has no indicator ring* |
| Action: | Use a correct rotor |

| | |
|---|---|
| *Reason:* | *Rotor is not seated on the motor shaft correctly* |
| Action: | Reseat the rotor on the motor shaft |

**Error no.: 21 Start bit is missing**

| | |
|---|---|
| *Reason:* | *A magnet of the indicator ring is missing* |
| Action: | Exchange the indicator ring of the rotor |

**Error no.: 22 Rotor is not mentioned in the rotor chart**

| | |
|---|---|
| *Reason:* | *Rotor is not authorized for this unit* |
| Action: | Insert only rotors authorized for this unit |

**Error no.: 25 Power failure**

| | |
|---|---|
| *Reason:* | *Power failure while rotor is in motion* |
| Action: | Open and reclose the lid, restart the centrifuge |

**Error no.: 30 Radius correction**

| | |
|---|---|
| *Reason:* | *Radius correction value too big* |
| Action: | Adjust the radius correction to the correct value |

**Error no.: 36 Relay for the frequency converter cannot be released**

| | |
|---|---|
| *Reason:* | *Defect on the power board* |
| Action: | Replace the power board |

**Error no.: 40 Error EEROPM**

| | |
|---|---|
| *Reason:* | *Serveral posibilities* |
| Action: | Restart unit, if the failure occures again, replace the control panel. |

**Error no.: 41 Power failure EEPROM**

| | |
|---|---|
| *Reason:* | *Serveral posibilities* |
| Action: | Restart unit, if the failure occures again, replace the control panel. |

**Error no.: 50,51 Memory failure**

| | |
|---|---|
| *Reason:* | *Internal or external memory failure* |
| Action: | Restart the unit, if the failure occurs again, replace the control panel |

**Error no.: 55 Overspeed**

| | |
|---|---|
| *Reason:* | *Overspeed sensor or motor speed sensor defect* |
| Action: | Check the overspeed sensor or the motor speed sensor and replace if necessary |

| | |
|---|---|
| *Reason:* | *Control panel or power board defect* |
| Action: | Replace the control panel or the power board |

**Error no.: 60 Motor speed sensor signal is missing**

| | |
|---|---|
| *Reason:* | *Motor speed sensor defective or parting of a cable at the sensor* |
| Action: | Replace the motor speed sensor |

**Error no.: 61 Speed signal without a turning of the rotor**

| | |
|---|---|
| *Reason:* | *Speed sensor is broken* |
| Action: | Install a new speed sensor |

**Error no.: 70 Interface of the frequency converter**

| | |
|---|---|
| *Reason:* | *Communication of controller, power board, interface cable and frequency converter is not working* |
| Action: | Interface test<br>Localization of the defective part by changing the components |

| | |
|---|---|
| *Reason:* | *Unpluged interface wire* |
| Action: | Plug in the interface wire plugs correctly |

**Error no: 82/83 Cutoff power board - frequency converter**

| | |
|---|---|
| *Reason:* | *Overcurrent, overvoltage or undervoltage due to power supply fluctuations* |
| Action: | Restart the unit, take care that the power supply is stable |

**Error no.: 84 Motor temperature / Frequency converter temperature**

| | |
|---|---|
| *Reason:* | *Defect at the motor (winding damage, bearing damage)* |
| Action: | Replace motor |

| | |
|---|---|
| *Reason:* | *Overtemperature switch in the motor is defective* |
| Action: | Replace motor (switch can't be replaced separately) |

| | |
|---|---|
| *Reason:* | *Defect at the frequency converter* |
| Action: | Exchange the frequency converter |

| | |
|---|---|
| *Reason:* | *Fan of the housing ventilation is defective, vent hole is covered, ambient temperature is too high* |
| Action: | Check the ventilation of housing, replace fan if necessary |

**Error no.: 90 Lid was open during run**

| | |
|---|---|
| *Reason:* | *Lid lock switch is defective* |
| Action: | Replace the lid lock |

| | |
|---|---|
| *Reason:* | *Wire to the lid lock is broken* |
| Action: | Repair the wire to the lid lock |

**Error no.: 94 Voltage drop during operation**

| | |
|---|---|
| *Reason:* | *Voltage drop of more than 10 Volt* |
| Action: | Restart the unit |

# spare part list
# Z 513 K

| Article | Order No. | Ident No. | Price 03 in EURO |
|---|---|---|---|
| frequency converter, 230 V with 2 PCB | 913.019 | 20-0238 | 808,90 |
| power board for control panel with 1 PCB 120 V / 230 V | 913.022 | HE 134.10.03 | 151,00 |
| control panel with 1 PCB | 913.033 | 271.01.11.02 | 455,00 |
| frequency converter, 230 V with 1 PCB | 913.034 | 20-0243 | 596,70 |
| motor, 230 V / 120 V | 923.007 | 274.08.40.02 | 393,80 |
| housing (for hinge version) | 933.031 | 277.01.13.00 | 340,70 |
| lid complete (for hinge version) | 933.032 | 277.01.21.01 | 269,30 |
| fuse 16 AT, 230 V, 5 x 20 mm | 940.025 | 25.0095 | 5,10 |
| fuse holder 230 V | 940.026 | 25.0096 | 16,40 |
| cover for fuse holder | 940.032 | 25.0109 | 7,20 |
| fan, 230 V | 940.046 | 32.0033 | 54,10 |
| micro switch "imbalance" | 940.069 | 38.0082 | 10,20 |
| rocker switch "power" vertikal | 940.086 | 38.0202 | 8,20 |
| line filter, 230 V / 120 V | 940.160 | 40-0111 | 87,80 |
| temperature sensor for control panel with 2 PCB (analog) | 940.168 | LK046 | 31,70 |
| temperature sensor for control panel with 1 PCB (digital) | 940.179 | LK107 | 38,80 |
| lid lock, motor-driven, 230 V for control panel with 2 PCB | 940.185 | 250.05 V01 | 286,70 |
| lid lock, motor-driven, 230 V for control panel with 1 PCB | 940.187 | 250.05 V07 | 278,50 |
| imbalance switch | 940.190 | 274.01.02.04 | 29,60 |
| rotor sensor | 940.191 | LK137 | 133,70 |
| contactor | 940.192 | 30-0137 | 95,90 |
| speed sensor (brown housing) | 940.199 | 32-0220 | 63,30 |
| fuse set, 230 V (16 AT) | 940.213 | LK185 | 5,10 |
| power connection with fuse holder, 230 V | 940.217 | LK128 | 73,50 |
| imbalance switch, only conecting cable | 940.220 | LK157 | 20,40 |
| magnet for speed sensor (without housing) | 940.236 | 44-0047 | 28,60 |
| potientiometer 10 K | 940.245 | 940.245 | 8,20 |
| micro switches set for motor driven lid lock | 940.260 | | 29,60 |
| motor for lid lock 230V | 940.261 | | 87,10 |
| motor for lid lock 120V | 940.262 | | 87,10 |
| speed sensor (white housing) | 940.263 | 940.263 | |
| magnet for speed sensor (with housing) | 940.264 | 940.264 | |
| stopper (imblance) | 950.006 | 20.5054 | 5,10 |
| centrifuge rubber feet | 950.014 | 26.5034 | 9,20 |
| motor rubber mount, diam. 30 x 30 mm, 50°-55° Shore | 950.019 | 26.5057 | 10,20 |
| hinge | 950.131 | 38-5597 | 22,50 |
| lid latch | 950.132 | 274.01.06.04 | 22,50 |
| motor rubber mount | 950.136 | 274.01.26.04 | 21,50 |
| motor cover | 950.137 | 277.01.24.03 | 67,40 |
| chamber gasket, 1630 mm, grey | 950.152 | 950.152 | 64,30 |
| injection nozzle | 960.003 | 23.5141 | 31,70 |
| solenoid valve, 230 V | 960.029 | 41.5137 | 117,30 |
| sight glas | 960.034 | 244.00.51.04 | 6,20 |
| expansion valve | 960.051 | 24-5077 | 80,60 |
| dryer | 960.052 | 39-5106 | 106,10 |
| compressor | 960.053 | 41-5178 | 499,80 |
| condenser with fan | 960.054 | 41-5179 | 198,90 |
| pressure guard | 960.055 | 23-5149 | 55,10 |
| starting relay | 960.066 | 960.066 | 75,50 |
| starting capacitor | 960.075 | 960.075 | 95,90 |
| power board 230 V for control panel with 2 PCB (exchange part) | R913.010 | R266.08U10.02 | 195,90 |
| control panel with 2 PCB (exchange part) | R913.013 | R271.01.12.02 | 481,50 |



effective 01st January, 2003
up to 31st Dezember, 2003

# spare part list
# Z 513

| Article | Order No. | Ident No. | Price 03 in EURO |
|---|---|---|---|
| frequency converter, 120 V with 2 PCB | 913.004 | 20-0235 | 720,20 |
| power board for control panel with 1 PCB 120 V / 230 V | 913.018 | HE 134.00.03 | 151,00 |
| frequency converter, 230 V with 2 PCB | 913.019 | 20-0238 | 808,90 |
| frequency converter, 120 V with 1 PCB | 913.021 | 20-0242 | 509,00 |
| frequency converter, 230 V with 1 PCB | 913.034 | 20-0243 | 596,70 |
| control panel with 1 PCB | 913.035 | 271.01.01.02 | 404,00 |
| motor, 230 V / 120 V | 923.007 | 274.08.40.02 | 393,80 |
| housing (for hinge version) | 933.029 | 274.01.13.01 | 315,20 |
| lid complete (spring hinge version) | 933.030 | 274.01.21.01 | 285,60 |
| fuse 16 AT, 230 V, 5 x 20 mm | 940.025 | 25.0095 | 5,10 |
| fuse holder 230 V | 940.026 | 25.0096 | 16,40 |
| fuse holder 120 V | 940.027 | 25.0098 | 21,50 |
| fuse 16 AT, 6,3 x 32 mm, 120 V | 940.029 | 25.0100 | 6,20 |
| cover for fuse holder | 940.032 | 25.0109 | 7,20 |
| fan, 230 V | 940.046 | 32.0033 | 54,10 |
| micro switch "imbalance" | 940.069 | 38.0082 | 10,20 |
| rocker switch "power" vertikal | 940.086 | 38.0202 | 8,20 |
| fan, 120 V | 940.158 | 32-0217 | 40,80 |
| line filter, 230 V / 120 V | 940.160 | 40-0111 | 87,80 |
| lid lock, motor-driven, 230 V for control panel with 2 PCB | 940.185 | 250.05 V01 | 286,70 |
| lid lock, motor-driven, 120 V for control panel with 2 PCB | 940.186 | 250.05 V02 | 286,70 |
| lid lock, motor-driven, 230 V for control panel with 1 PCB | 940.187 | 250.05 V07 | 278,50 |
| lid lock, motor-driven, 120 V for control panel with 1 PCB | 940.188 | 250.05 V08 | 278,50 |
| imbalance switch | 940.190 | 274.01.02.04 | 29,60 |
| rotor sensor | 940.191 | LK137 | 133,70 |
| contactor | 940.192 | 30-0137 | 95,90 |
| speed sensor (brown housing) | 940.199 | 32-0220 | 63,30 |
| fuse set, 230 V (16 AT) | 940.213 | LK185 | 5,10 |
| fuse set, 120 V (16 AT) | 940.214 | LK186 | 6,20 |
| power connection with fuse holder, 230 V | 940.217 | LK128 | 73,50 |
| power connection with fuse holder, 230 V | 940.218 | LK134 | 88,80 |
| imbalance switch, only conecting cable | 940.220 | LK157 | 20,40 |
| magnet for speed sensor (without housing) | 940.236 | 44-0047 | 28,60 |
| potientiometer 10 K | 940.245 | 940.245 | 8,20 |
| micro switches set for motor driven lid lock | 940.260 | | 29,60 |
| motor for lid lock 230V | 940.261 | | 87,10 |
| motor for lid lock 120V | 940.262 | | 87,10 |
| speed sensor (white housing) | 940.263 | 940.263 | |
| magnet for speed sensor (with housing) | 940.264 | 940.264 | |
| stopper (imblance) | 950.006 | 20.5054 | 5,10 |
| centrifuge rubber feet | 950.014 | 26.5034 | 9,20 |
| motor rubber mount, diam. 30 x 30 mm, 50°-55° Shore | 950.019 | 26.5057 | 10,20 |
| hinge | 950.131 | 38-5597 | 22,50 |
| lid latch | 950.132 | 274.01.06.04 | 22,50 |
| motor cover | 950.135 | 274.01.10.04 | 33,70 |
| motor rubber mount | 950.136 | 274.01.26.04 | 21,50 |
| chamber gasket, 1630 mm, grey | 950.152 | 950.152 | 64,30 |
| sight glas | 960.034 | 244.00.51.04 | 6,20 |
| power board 120 V for control panel with 2 PCB (exchange part) | R913.009 | R266.08.11.02 | 200,00 |
| power board 230 V for control panel with 2 PCB (exchange part) | R913.010 | R266.08U10.02 | 195,90 |
| control panel with 2 PCB (exchange part) | R913.012 | R271.01.02.02 | 441,70 |
| power board for control panel with 1 PCB 120 V / 230 V, (exchange part) | R913.018 | RHE 134.00.03 | 115,30 |



effective 01st January, 2003
up to 31st Dezember, 2003

# spare part list
# Z 513 K

| Article | Order No. | Ident No. | Price 03 in EURO |
|---|---|---|---|
| power board 120 / 230 V (exchange part) | R913.022 | RHE 134.10.03 | 115,30 |
| control panel with 1 PCB (exchange part) | R913.033 | R271.01.11.02 | 341,70 |



effective 01st January, 2003
up to 31st Dezember, 2003

# spare part list
## Z 513

| Article | Order No. | Ident No. | Price 03 in EURO |
|---|---|---|---|
| control panel with 1 PCB (exchange part) | R913.035 | R271.01.01.02 | 303,00 |



effective 01st January, 2003
up to 31st Dezember, 2003